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KEARNS (H. G. H.). **Control of Apple Sawfly.**—*Fruit Grower* 1933. reprint 4 pp. London, 9th November 1933. **Control of the Apple Sawfly** (*Hoplocampa testudinea*).—*Herefordsh. Co. Coun. agric. quart. J.* 1934 reprint 6 pp. Hereford, March 1934.

These two papers deal briefly with the life-history [*cf. R.A.E.*, A **20** 579] and control of the apple sawfly [*Hoplocampa testudinea*, Klug] in England, and the first also with the method of determining the degree of infestation. The adults emerge from cocoons in the soil during the first 3 weeks of May, maximum emergence coinciding with the commencement of blossoming of the mid-season flowering varieties of apple. They are usually only attracted to the blossom during still, sunny intervals; low temperatures, rain and wind cause them to remain in the grass. During the bright intervals, the females are intensely active and lay most of their eggs. One or more eggs may be laid in each blossom, although they may not all be laid at the same time. The incubation period varies from 10 to 18 days. Most of the larvae burrow deeply into the fruitlet at first, but after a week they move towards the surface of the lower side and remain just below the skin. Within another few days they retreat into the interior, grow rapidly, and eventually become migratory and attack other apples. Four to five weeks after hatching, the larvae migrate or fall to the earth and hibernate till the following spring. Occasionally a partial second brood occurs. A list of several varieties of apple shows their susceptibility to attack.

In addition to the latter part of the incubation and the early part of the larval period, the time at which the larva occupies a burrow just below the surface of the skin is a vulnerable period in the life-history. In order to apply sprays at the correct time, preliminary observations should be made to detect adults round the opening flowers, especially on hot days, and random samples of flowers should be examined for the presence of a brown, rusty scar below the calyx cup, which indicates that oviposition has taken place. Oviposition occurs chiefly during and after full-blossom, but in wet or dull weather the eggs may be laid at petal-fall, when the percentage infestation can be determined by sorting random samples of 100 flowers into infested and uninfested groups. The infested flowers should be examined to determine the stage of egg development; if 20 per cent. or more of the eggs are exposed by rupture of the calyx tissue, it is time (probably coinciding with petal-fall in the upper branches) to apply a spray containing nicotine. The flowers may also be examined when 80 per cent. of the blossom has fallen, and again 1 and 5 days after petal-fall, by placing 50 of each variety in a shallow petri dish and counting the larvae emerging on each of the subsequent 4 days. The appearance of 10 or more larvae from 50 flowers indicates the time for the first application of spray, and the appearance of 25 or more that for the second application (usually 5–7 days later). One application is usually sufficient in a 10 per cent. infestation, but two are necessary for one of 20 per cent. or over. The essentials for efficient spraying are discussed; the spray must be applied with force and must contain an efficient wetting agent, especially for varieties in which the calyx cup closes rapidly after petal-fall. In field trials, two sprays reduced the loss of fruit from 96 per cent. to less than 2 per cent. A suitable combination of spray constituents may also check several other apple pests. The addition of lime-sulphur does not reduce the toxicity of sprays if a suitable spreader is employed. The inclusion of lead arsenate in sprays reduces infestation appreciably,

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and to some extent minimises the results of selecting an incorrect spray date, but it is preferable not to use it in conjunction with lime-sulphur. Three double and one single spray methods are recommended, the basis of the formulae [*cf.* **21** 557] being 8 oz. nicotine (98 per cent.), ½ lb. Lethalate wetting preparation or 2½ lb. Agral I or equivalent wetter, and 100 gals. water. In the double spray programmes, the additional constituents in the first and (in brackets) the second spray were : 2 lb. finely divided lead arsenate (1–1½ gals. lime-sulphur, except for sulphur-sensitive varieties) in the first method ; 2 lb. finely divided lead arsenate (1–1½ gals. white oil emulsion, the emulsifier obviating the necessity of a wetting agent) in the second ; and 1–1½ gals. lime-sulphur in both sprays in the third. Where only one application can be given, a satisfactory formula is 1½ gals. lime-sulphur and 2 lb. lead arsenate (not too finely divided), with wetting agent, nicotine and water as above. The concentration of nicotine should be increased by 2 or 3 oz. in wet weather to compensate for any dilution.

STANILAND (L. N.) & BEAUMONT (A.). **Tenth Annual Report of the Department of Plant Pathology for the Year ending September 30th, 1933.**—*Pamphl. Seale-Hayne agric. Coll.* no. 42, 39 pp., 3 figs. Newton Abbot, Devon [1934].

A search for alternative food-plants of *Myzus ornatus*, Laing (violet aphis) [*cf. R.A.E.*, A **21** 559] revealed its presence on *Ranunculus bulbosus* and *Sisymbrium officinale* in south Devon, but not on wild violet. It was recorded in Dublin in November 1932 on chrysanthemum and in Devon and Cornwall during November 1933 on the petals of anemones, which are distorted and discoloured, and show symptoms resembling " breaking " of tulips [*cf.* **22** 231]. *M. circumflexus*, Buckt., which was associated with it on anemone, was apparently less injurious.

Strawberry plants treated for 20–30 minutes in water at 110°F. in 1930 [**19** 373 ; *cf.* **22** 234] are still healthy and have yielded good crops, though spraying has been necessary against subsequent infestations by *Capitophorus potentillae*, Wlk. (*fragariae*, Theo.) and *Tetranychus telarius*, L. Runners may be treated in a bucket heated by means of an ordinary gas burner as well as in thermostatically controlled baths heated by electricity or oil, provided that the temperature of the water is carefully regulated. They should be prevented from coming into direct contact with the bottom of the bath by an iron grid or a wire cage on short legs. Washing them with cold water before treatment will remove the soil, which otherwise accumulates at the bottom of the bath and affects the heating, and immersing them in cold water afterwards will cool them quickly and induce better growth. In experiments, plants treated at 110°F. for 15, 20 and 30 mins. in August 1932 or March 1933 grew almost as well as plants treated only with cold water. Treatment for 15 and 20 mins. gave good results, but after 30 mins. there was a somewhat greater loss of runners when planting conditions were not good. Immersion for 10 mins. at 118°F., as recommended in America, was only satisfactory in August and September. Tests in 1933 indicated that exposure for 15 mins. to 110°F. is sufficient to control *Tarsonemus fragariae*, Zimm., and *C. potentillae* only, but that where large batches are concerned, better results are more likely to be obtained after 20 mins., which is probably long enough to kill *Tetranychus*.

Measures to be practised each month against the diseases and pests of narcissus are given ; they include an arsenical bait spray against *Merodon equestris*, F., and *Eumerus* spp. [**19** 374], the life-cycles of which are tabulated, and hot water treatment of the bulbs against flies, mites and Nematodes [**21** 448]. Pests that were injurious during the year under review included : *Meligethes aeneus*, F., which caused up to 15 per cent. loss of broccoli seed in association with *Ceuthorrhynchus assimilis*, Payk. ; *C. pleurostigma*, Marsh., which attacked cabbage in one area ; *Eriosoma lanigerum*, Hsm., on apple ; *Incurvaria rubiella*, Bjerk., which appears to be increasing on raspberries ; *Tetranychus telarius* on violets ; and *Tarsonemus approximatus* var. *narcissi*, Ewing, which appears to be widely distributed on narcissus, causing particular damage to bulbs forced under glass. A species of *Phorbia* was observed in south Devon tunnelling in young canes of loganberry [**22** 362], which had to be cut out and destroyed. Some injury was caused to seedling anemones by *Smynthurus viridis*, L.

Komárek (J.) & others. **Mnišková kalamita v létech 1917–1927.** [The Nun Moth Outbreaks in the Years 1917–1927.]—*Rec. Trav. Inst. Rech. agron. Tchécosl.* **78** no. 1 pp. 1–256, 11 figs., 4 graphs, 14 pls., 4 maps, 18 pp. refs. Prague, 1931. (With a Summary in German.) [Recd. May 1934.]

This monograph deals with the severe outbreaks of *Lymantria* (*Liparis*) *monacha*, L., that occurred in western Czechoslovakia from 1917 to 1927. An area of more than 1,400,000 acres of forest was infested, of which over 262,000 acres were entirely defoliated. The loss sustained is estimated at over £1½ millions. Outbreaks occurred at altitudes of from 650 to 2,300 ft. [*cf. R.A.E.*, A **10** 442 ; **19** 328], especially among trees of uniform age thickly planted on large cleared areas and badly ventilated, the stands that suffered most being between 40 and 80 years old. About a century ago outbreaks (a chronological list of which is given) usually occurred in pure stands of pine, but from about 1892 infestation spread to mixed stands of conifers, or conifers and deciduous trees. In recent observations, unmixed stands of spruce were attacked in 418 cases, mixed conifers in 125, mixed conifers with deciduous trees in 70, pure stands of pine in 24, and pure silver fir [*Abies*] or beech woods in 2 each. Pine was ignored in the presence of either silver fir or beech, and in pure stands the percentage of completely defoliated pines was negligible [*cf.* **10** 264 ; **16** 57 ; **19** 662].

In Czechoslovakia, where the moth is found everywhere except at altitudes of above 3,300 ft., outbreaks occur in the same areas at intervals of approximately 7–10 years. They are, however, almost exclusively limited to the western provinces. The moths are on the wing from mid-July till mid-August, and in the laboratory lived 14–20 days. The females normally shelter well within the stands. Under crowded conditions, however, the moths travel considerable distances [*cf.* **15** 508] and also infest orchards [**10** 291]. Oviposition, which may begin soon after emergence [**12** 258], usually occurs on the lower part of the trunk where the bark is rough [**12** 457 ; but *cf.* **22** 85], one female laying up to 100 or even 200 eggs, which hatch from the end of April till mid-May. Experiments showing the resistance of the eggs to low winter temperatures and the effect of temperature

and humidity on the young larvae in spring are discussed [**21** 496 ; *cf.* also **21** 389, etc.]. The larvae hatch in late April and the first half of May, and under favourable conditions the larval stage averages 55–60 days. The temperature in Czechoslovakia in May is never detrimental to the young larvae, but they cannot long survive an air humidity below 40 per cent. In the third and fourth instars, the larvae fed and developed at temperatures ranging from 5 to 33°C. [41–91·4°F.], but died above 37°C. [98·6°F.] or below —4°C. [24·8°F.]. Outbreaks are therefore apparently liable to occur where the June temperature does not drop below 5°C. [41°F.] or rise above 30°C. [86°F.], the optimum being a mean of 15–17°C. [59–62·6°F.]. In the first three instars, the larvae feed almost exclusively on the buds, or May shoots of needles. The very young larvae never feed on old spruce needles, and the others only in the absence of fresh ones. On pine, however, they generally prefer needles of the two previous years [*cf.* **12** 258 ; **17** 334]. The first-instar larvae readily migrate by means of threads, being sometimes carried by wind for considerable distances. Older larvae lack this migratory instinct, so that sometimes as many as 90 per cent. die of starvation on a defoliated tree. Since few larvae abandon a tree, the author does not consider adhesive bands to be of much use [*cf.* **13** 206 ; **22** 85]. The pupal stage, in cracks in the bark or at the base of the branches and in the axils of the twigs, lasts from 9 to 14 days in July.

The causes of the recent outbreaks are reviewed from the literature and discussed. The vitality of the first-instar larvae is decisive, since subsequent instars are practically not affected by natural control factors (other than parasites). Birds are of very little value, as they prefer the larvae and pupae of the Tachinid parasites ; they also feed on the seeds of conifers and introduce weeds into coniferous stands.

Tachinids were the commonest parasites, but did not always increase in proportion to the host. Their numbers sometimes declined sharply in the year following a period of abundance. Parasitism by them averaged 30–60 per cent., with a maximum of 80. The most important species is *Phorocera* (*Parasetigena*) *silvestris*, R.-D. (*segregata*, auct.) [**21** 496], the bionomics of which are briefly discussed. *Apanteles solitarius*, Ratz., the most abundant Hymenopterous parasite [*cf.* **14** 426], attacked the very young larvae, abandoning them in their third instar. Other species attacking the larvae were *Pimpla instigator*, F., *P. inquisitor*, Scop., *Ichneumon disparis*, Poda, and *Automalus alboguttatus*, Grav., all of which pupated within the host pupa. *Ophion luteus*, L., which has not previously been recorded as a parasite of *L. monacha*, was twice reared from the pupae. Egg-parasites of the genus *Trichogramma* were practically absent. *Formica rufa*, L., was very useful, many trees that grew close to the ant-hills being entirely cleared of the young larvae [*cf.* **13** 209], though these ants also destroy Tachinids. The Pentatomid, *Arma* (*Troilus*) *lurida*, F., which was very abundant and active, readily attacked the larvae and pupae. Other predators included *Calosoma sycophanta*, L., which was only abundant locally, and the Silphid, *Thanatophilus* (*Xylodrepa*) *quadripunctatus*, L., which is chiefly found on deciduous trees. Larvae of *Hemerobius* and *Chrysopa* destroy a great number of the very young larvae. A list is given, arranged by S. Kolubajiv, of the Dipterous and Hymenopterous parasites recorded in the literature, with descriptions of the most important species and keys.

Polyhedral disease of the larvae began to spread in 1918, but generally appeared too late to prevent outbreaks. Until 1921, only a small minority were infected. Work on this disease [**10** 28 ; **12** 294 ; **14** 310 ; **22** 85] is reviewed.

Keys are given by A. Pfeffer to the Scolytids occurring in spruce infested by *L. monacha* and to their galleries. Up to an altitude of 650 ft., where only a few stands of spruce occur, the only species found in numbers were *Hylastes* (*Hylurgops*) *palliatus*, Gyll., and *Xyloterus lineatus*, Ol., both of which were also abundant in defoliated stands between 650 and 2,000 ft. on dying and already dead spruces, in association with smaller numbers of *Dryocoetes autographus*, Ratz. *Polygraphus poligraphus*, L., which bred in numbers in lopped branches and tops of trees left lying about in the forests, readily passed to the upper parts of standing and almost completely green spruces, often causing their death and always rendering them susceptible to infestation by *Ips cembrae*, Heer, *I. typographus*, L., and *I. amitinus*, Eich., which attack the trunk. Of these, *I. cembrae* was the most numerous and important ; though usually found on larch, it readily migrated to spruce. *I. typographus*, which only breeds in areas with an annual rainfall of at least 30 ins., was locally abundant in damp places. *I. amitinus* was scarce. *Dendroctonus micans*, Kug., was numerous in some dry areas in central Bohemia. Other species prevalent were : *Hylastes cunicularius*, Er., *Cryphalus abietis*, Ratz., *Ips laricis*, F., *I.* (*Pityogenes*) *chalcographus*, L., and a species recorded as *Pityophthorus micrographus*, L., which in the key is stated to be *P. pityographus*, Ratz.

Adhesive bands, though probably of no value in control, proved useful in the spread of polyhedral disease, owing to the accumulation of starving larvae below them, and as an index of infestation [**22** 85] and of the condition of the larvae. Light-traps, besides being usually too costly, are of no practical value ; of the moths captured, only 10–15 per cent. were females, of which about 80 per cent. had already oviposited. Liberation against the swarming adults of phosgene gas from bombs placed in an infested stand proved useless as well as dangerous. A very complete account is given of the work carried out in Silesia in 1926 and 1927 of dusting with calcium arsenate from aeroplanes [**17** 581]. The treated areas covered about 925 acres in the first year and 2,500 in the second. This treatment failed only when unexpected rain washed off the dust.

The importance of constant surveys is emphasised. Counts of eggs on felled trees only afford a rough indication of future infestation. First-instar larvae should be counted in April throughout the hatching period below bands placed at a good height up the trunks. The presence of 80–100 larvae below the band points to the necessity of a further survey. Another method, evolved by Dr. Sigmond, consists in felling a few trees in stands where the adults were abundant and stacking them with the bark on. In the centre of the stack or along the edges are placed one or two protruding stakes ; the newly hatched larvae will concentrate at the top of these, where they may easily be collected. The numbers of the older larvae in the crowns can only be estimated by counting the excreta. Recording the numbers of females captured during the flight period is the easiest method of noting an increase in infestation. A survey of the adults should be made every year, whereas counts of larvae are only necessary when an increase in infestation becomes apparent.

GASOW (H.). **Beschädigungen des Reiskäfers** (*Calandra oryzae* **L.**) **an Aepfeln.** [Injuries to Apples by *C. oryzae*.]—*Anz. Schädlingsk.* **10** no. 5 p. 59, 1 fig. Berlin, 15th May 1934.

Calandra oryzae, L., apparently introduced with poultry-food into a store-room in Westphalia, was found in the autumn of 1933 attacking apples spread out in a room below. The injury was superficial, but might afford points of entry for fungi and mites.

BRAUN (K.). **Tätigkeitsbericht der Biologischen Reichsanstalt für Land- und Forstwirtschaft, Zweigstelle Stade . . . vom 1. April 1933 bis 31. März 1934.** [Report from 1st April 1933 to 31st March 1934 of the Stade Branch of the Imperial Biological Institute for Agriculture and Forestry.]—*Altländer Ztg* 1934, nos. 62, 66, 70, 74, 78, 82, reprint 6 pp. Jork, 1934.

In experiments on *Cheimatobia brumata*, L., on fruit trees in the Lower Elbe district [*cf. R.A.E.*, A **21** 527], it was found that the eggs resisted temperatures of −21°C. [−5·8°F.]. The soil moisture preferred for pupation was equivalent to 20–50 per cent. saturation. The survival of the older larvae and the pupae was highest at a relative atmospheric humidity of 90–100 per cent.

Examination of the fruits of *Lonicera tatarica* [*cf.* **22** 247 ; etc.] revealed extensive infestations by *Rhagoletis cerasi*, L., sometimes reaching 100 per cent. As cherries in this district are not infested by this fruit-fly, the eradication of *L. tatarica* was undertaken.

JANCKE (O.). **Zur Ausbreitungsfähigkeit der Blutlauszehrwespe** *Aphelinus mali* **Hald.** [On the Capacity for Spread of *A. mali*, a Parasite of the Woolly Apple Aphis.]—*Arb. physiol. angew. Ent. Berl.* **1** no. 2 pp. 101–109, 2 figs., 13 refs. Berlin, 25th May 1934.

The author discusses the degree to which *Aphelinus mali*, Hald., is able to spread from a place where it has been released for the control of *Eriosoma* [*lanigerum*, Hsm.] on apple, partly on the basis of his own observations in Germany. He considers that instances of its appearance at some distance from a place of liberation [*cf. R.A.E.*, A **13** 58] are due to accidental carriage by man. Its numbers are sometimes reduced owing to the tardy formation of colonies of the host in spring, and the more or less marked decrease of the latter that occurs in July and August normally brings the abundance of the parasite down to the level at which it stood shortly after the winter.

ECKSTEIN (F.). **Untersuchungen zur Epidemiologie und Bekämpfung von** *Pyrausta nubilalis* **Hb. und** *Platyparea poeciloptera* **Schr.** [Investigations on the Epidemiology and Control of *P. nubilalis* and *P. poeciloptera*.]—*Arb. physiol. angew. Ent. Berl.* **1** no. 2 pp. 109–131, 2 figs. Berlin, 25th May 1934.

Investigations at Rastatt, Baden, in 1929–31 showed that the flights of *Pyrausta nubilalis*, Hb., continue each evening until the temperature falls below 15°C. [59°F.]. Above 16°C. [60·8°F.], conditions for an abundant flight become increasingly favourable when

there is a marked difference between the dew-point and the temperature ; at Rastatt, the optimum difference was 5·5°C. [9·9°F.]. In a part of a maize field that is misty, there is practically no flight, and subsequent infestation is relatively low.

Covering heaps of maize straw with the remains of potato plants, so as to trap larvae that migrate to them after the straw has become too moist [*R.A.E.*, A **17** 217], was not always effective. Apparently the requisite amount of moisture, which is unknown, does not always occur in the straw. Field experiments with *Bacterium* (*Bacillus*) *thuringiense* [*cf. R.A.E.*, A **19** 150, 155, etc.] gave negative results, and those with *Metarrhizium anisopliae* [*cf.* **20** 316 ; etc.] were inconclusive. In the laboratory, *Beauveria* (*Botrytis*) *bassiana* killed the larvae in the straw, but no work was done in the field.

Since 1924, *Platyparea poecilоptera*, Schr., has increased in Baden. Young asparagus was particularly injured in 1926 and 1927, when the weather was unfavourable to the plants after having been favourable to the fly in the preceding two years. From 500 asparagus stems collected in December 1930, 459 flies emerged between 24th April and 5th June, proving the importance of destroying all crop remnants.

Experiments showed that the fly is attracted, not by the colour, but by the shape of the sprouting asparagus [**20** 57]. Of possible repellents tested, the majority were ineffective, but slow-evaporating chlorinated phenols and naphthalene protected asparagus plants from infestation. In experiments with strong-smelling substances as baits, none proved attractive. Infestation was very greatly reduced by fixing screens of newspaper round the plants [*cf.* **21** 641], but the burning of all crop remnants in autumn is considered the simplest and cheapest means of control.

MEYER (E.). **Ueber eine schwere Schädigung von Runkeln durch die Capside** *Calocoris norvegicus* **Gmel.** [Serious Injury to Beet caused by *C. norvegicus*.]—*NachrBl. dtsch. PflSchDienst* **14** no. 6 pp. 57–59, 2 figs., 13 refs. Berlin, June 1934.

In 1933, beet in a field in Holstein was severely attacked by nymphs of *Calocoris norvegicus*, Gmel. Some of the young plants, which had been sown in May, were entirely destroyed, while the undeveloped leaves and hearts of the others were so much injured that the more heavily infested half of the field was ploughed under. The plants nearest a hedge suffered most, and it is assumed that the bugs migrated from there. Of various neighbouring crops, mustard alone was heavily infested, and as adults predominated on it, they had probably migrated from the beet. Adults also occurred on wild plants, especially *Verbascum nigrum*. In cage experiments, beet suffered much more severely as a result of infestation by nymphs and adults than did other cultivated plants, but the injury was apparently due to a toxin injected by the bugs in feeding and not to a virus disease, though in Ireland *C. norvegicus* (*bipunctatus*, F.) has been found to transmit potato leaf-roll [*R.A.E.*, A **11** 392]. Some observations suggested that this bug has two generations a year in Holstein.

REICHERT (A.). **Rosenschädlinge.** [Rose Pests.]—*Kranke Pflanze* **11** no. 6 pp. 69–71, 1 pl. Dresden, 1934.

The larvae of the Tortricids, *Eucosma* (*Notocelia*) *roborana*, Tr., and *E.* (*Epiblema*) *tripunctana*, Schiff., which infest roses in Germany,

hatch from overwintered eggs in spring and live and pupate in shelters of leaves webbed together. The adults appear in June and July, with some stragglers in August. *Argyroploce ochroleucana*, Hb., which has a simular life-history, has been observed in Saxony for several years on roses, from which it is rarely recorded in the literature.

Krankheiten und Beschädigungen der Kulturpflanzen im Jahre 1931. [Diseases and Injuries of Cultivated Plants in 1931 in Germany.] —*Mitt. biol. Reichsanst.* no. 48, 72 pp., 48 maps, 2 figs. Berlin, March 1934.

This report contains annotated lists of the insect pests recorded in Germany in 1931, showing their local distribution and divided according to the class of crop attacked. In a supplement, Dr. H. Morstatt discusses the largely accepted view that there has been in recent years an increase of diseases and pests of plants, but considers that in the case of indigenous pests in Germany this view is merely due to a more systematic organisation of cultivation and accurate observation of the injury caused, so that normal periodical outbreaks of pests receive more attention.

Faes (H.), Staehelin (M.) & Bovey (P.). **La lutte contre les ennemis des arbres fruitiers, insectes et champignons en 1932.**—*Landw. Jb. Schweiz* **48** no. 3 pp. 241–280, 8 figs., 1 pl. Berne, 1934. (With a Summary in German.)

The development cycle of *Cydia* (*Carpocapsa*) *pomonella*, L., was recorded in a number of localities in Switzerland and proved to be more uniform than in the preceding year [*R.A.E.*, A **21** 297]. There was no second generation in Vaud, and if one occurred in Valais it was of no importance. Apples were sufficiently protected by a calyx spray of lead arsenate, followed by a cover spray 3 weeks later ; calcium arsenate was less effective.

Observations on *C.* (*Laspeyresia*) *funebrana*, Treit., were made in Vaud and Valais in places with markedly different climates. In both districts there were two complete generations, the moths occurring in May–June and July–August. The first-brood eggs were always laid on the sides of the plums least exposed to sunshine and hatched in 8–10 days. The larvae entered the fruits at any point and left them after 3 weeks to spin cocoons in the bark. The second-brood larvae are found in ripe plums. The fall of fruits owing to infestation by the first generation usually occurs at the same time as that due to physiological causes, so that it escapes attention. The addition to Bordeaux mixture of 1 per cent. nicotine applied on 10th June against the first generation and on 25th July against the second proved an effective measure. Almost as good control was obtained by the first application only, ovipositing females of the new generation having probably avoided fruits with traces of the spray.

Shale dust, powdered lime and shale oil applied in April appeared to be of some value as repellents in reducing infestation of apple blossom by *Anthonomus pomorum*, L.

Wiesmann (R.). **Untersuchungen über die Lebensgeschichte und Bekämpfung der Kirschfliege** *Rhagoletis cerasi* **Linné. II. Mitteilung.** [Investigations on the Life-history and Control of the Cherry Fly. Second Communication.]—*Landw. Jb. Schweiz* **48** no. 3 pp. 281–338, 13 figs., 28 refs. Berne, 1934. (With a Summary in French.)

The following is largely taken from the author's summary of studies on *Rhagoletis cerasi*, L., in Switzerland [*cf. R.A.E.*, A **21** 681 ; **22** 246].

In 1933, the flies were emerging from 22nd May to 5th July and had a total flight period of 62 days. Observations indicated that the females can oviposit after a flight of 220 yards, but probably very seldom fly further than about 330 yards. Figures are given of the wings of this Trypetid and of *Acidia heraclei*, L., *Trypeta* (*Spilographa*) *zoë*, Mg., and *Hemilea dimidiata*, O. Costa, which are liable to be mistaken for it.

Though the addition of sweet-smelling substances to bait-sprays did not attract the flies, they ingested the poison more readily when it was sweetened [*cf.* **21** 525], preferring raw beet-sugar to molasses, glycerine, saccharin, etc. The most effective bait-spray consisted of 1 per cent. of a proprietary nicotine preparation and 3 per cent. raw sugar. This showed promise in the field, but owing to rainy weather in June five applications only reduced infestation 50 per cent. Rain also prevented the success of applications of this bait-spray on the ground or of a derris dust against the newly emerged flies. The dust gave good results in the laboratory when kept dry. Apparently 100 per cent. control of emerging flies was obtained by scattering paradichlorobenzene on the ground in an isolated clump of cherry trees at the rate of 1 oz. to 15 sq. ft. at the beginning of the flight period and again 14 days later. Naphthalene was somewhat less effective.

Against the developing pupae, though not against undeveloped ones, lysol (about 4 pints of a 3 per cent. solution to 5 sq. ft.) proved highly effective. In an isolated group of trees, an 8 per cent. tar distillate spray applied at the same rate proved successful, but was expensive. Against the larvae in the fallen fruit, the best results were obtained by scattering crude naphthalene (5 oz. to 6 sq. ft.) at the beginning of the harvest, or 8 days before it in the case of late varieties.

de Fluiter (H. J.). **Korte mededeeling over** [A short Communication on] *Rondania dimidiata* **Mg. (Dipt. Tachinidae) en** *Pygostolus multiarticulatus* **Ratz. (Hym. Braconidae).**—*Tijdschr. Ent.* **77** no. 1–2 pp. xiii–xv. Amsterdam, 1934.

In the course of investigations on *Brachyderes incanus*, L., attacking pines in Holland [*cf. R.A.E.*, A **21** 375], the Tachinid, *Rondania dimidiata*, Mg., and the Braconid, *Pygostolus multiarticulatus*, Ratz., were reared from the adult weevils. In the laboratory, a female of the Tachinid was seen thrusting its ovipositor between the mandibles of a weevil while the latter was feeding, but whether an egg or a larva was deposited could not be ascertained. When an unfertilised female of *Pygostolus* was placed with the weevils, several larvae were subsequently dissected from them.

Malenotti (E.). **Osservazioni sulla** *Laspeyresia molesta*. [Observations on *Cydia molesta*.]—*G. Agric. Domenica* **44** no. 23 p. 225, 6 figs. Rome, 10th June 1934.

Cydia (*Laspeyresia*) *molesta*, Busck, which has already been recorded from other parts of Italy [*R.A.E.*, A **22** 173, 191], appeared in Venetia in 1933. Of 284 small peaches and 198 peach twigs picked on 15th May, 84 and 12 respectively contained the larvae. On 30th May, the first adult was bred from larvae in the fruits. As both twigs and fruits were infested contemporaneously and no injury was observed before May, it was evident that the larvae in the fruits were those of the first generation. The anal combs of the larvae of *C. molesta* and *Anarsia lineatella*, Zell., are figured to enable them to be distinguished; the latter species also infests peaches in Venetia, but is readily controlled by winter insecticides.

Monterosso (B.). **Osservazioni e ricerche sperimentali su lo svernamento di** *Pediculoides ventricosus*. [Observations and experimental Investigations on the Hibernation of *P. ventricosus*.]—*Boll. Zool.* **5** no. 3 pp. 65–81. Turin, June 1934.

The fertilised females of the last autumn generations of *Pediculoides ventricosus*, Newp., hibernate in a condition of partial inactivity that becomes complete at temperatures approaching freezing point, but when exposed to artificial warmth they become capable of reproduction. As this mite normally parasitises larvae or pupae [*cf. R.A.E.*, A **14** 564], insects such as *Bruchus* (*Laria*) *rufimanus*, Boh., that overwinter in the adult stage are only infested by it in summer. The mite was observed on larvae and (less often) pupae of the Bruchid in stored beans (*Vicia faba*) in Italy during June–September, but is never found in beans in winter.

Feytaud (J.). **La question doryphorique au début de la campagne 1934.**—*Rev. Zool. agric.* **33** nos. 1–2 pp. 1–16, 17–32, 1 map. Bordeaux, January–February 1934. [Recd. June 1934.]

Although the area in France infested by *Leptinotarsa decemlineata*, Say, on potato [*R.A.E.*, A **21** 399] increased during 1933, it nowhere exceeded the regular forecasts and in certain sectors showed a tendency to become stabilised. Infestation spread to three new departments (Morbihan, Côtes-du-Nord and Eure) and one (Basses Pyrénées) ceased to be infested. No change has been made in the control measures employed, but in some areas considerable progress has been made in the regularity of applying them. Experiments in the use of *Petunia* [*cf.* **20** 240; **21** 495] as a trap-plant proved it to be ineffective. With a view to introduction into France against *L. decemlineata*, collections have been made in the United States of the Carabid, *Lebia grandis*, Hentz, the Pentatomids, *Perillus bioculatus*, F., and *Podisus maculiventris*, Say, and the Tachinids, *Doryphorophaga aberrans*, Tns., and *D. doryphorae*, Riley [*cf.* **20** 561]. Breeding is being carried on in France, but only *L. grandis* has been liberated.

The appearance of *L. decemlineata* in England [**22** 115] is discussed.

La Défense sanitaire des Végétaux. Tomes I & II. Compte-rendu des Travaux du Congrès de la Défense sanitaire des Végétaux, Paris 24–26 Janvier 1934.—Demy 8vo, 2 vols. illus. Paris, Lig. nat. Lutte contre Ennemis des Cultures, 1934.

The first volume gives the full text of all but one of the papers submitted, and the second contains that portion or summary of each paper actually read, followed by the discussion on it. The papers of entomological interest are here noticed, the pages in each volume appearing in brackets after the title.

Volume II contains the text of one paper, Evolution de la pathologie végétale dans l'espace et dans le temps (11–58), by E. Foëx, that was omitted from Volume I. It deals with the history of plant pests and diseases from ancient times to the present day. The 19th and 20th centuries are dealt with in detail under many headings covering control measures in all countries of the world, the introduction of beneficial insects and the question of international entomological relations.

In Le doryphore (17–30 ; 71–84), J. Feytaud and R. Dupoux review the campaign against *Leptinotarsa decemlineata*, Say, in France, giving details of the measures employed in commercial potato fields. R. Mayné, in La mouche de la betterave (31–40 ; 85–90), discusses the bionomics and control of *Pegomyia hyoscyami*, Panz., on sugar-beet in Belgium. In Les vers de la vigne (41–54 ; 91–95), P. Marsais gives an account of *Sparganothis pilleriana*, Schiff., *Clysia ambiguella*, Hb., and *Polychrosis botrana*, Schiff., attacking vines in France and the measures that have proved most effective against them. J. Verguin, in Les insectes des fruits (55–63 ; 97–102), gives brief descriptions of some 20 species of insects attacking fruit trees, etc., in France, together with notes on their bionomics and control. A paper by A. Balachowsky entitled Les pucerons et les cochenilles (pp. 65–105 ; 103–114) comprises a general survey of the classification and bionomics of Aphids and Coccids, followed by notes on injurious species, arranged under the food-plants, and on control measures.

L. Mesnil, in Insectes nuisibles aux céréales (107–131 ; 115–117), gives a general account of the insects attacking cereal crops throughout the world, classifying them according to geographical and climatic regions, with a key, mainly based on the type of injury caused, to the commoner pests in France and a list of those likely to be introduced from other countries. Elaterids, which are among the most common and dangerous insects attacking cereals, and *Oscinella frit*, L., which is also sometimes very injurious in France, are dealt with in greater detail, notes being given on their biology, the type of injury they cause and measures for their control. In Les insectes auxiliaires en agriculture (133–137 ; 119–120), P. Vayssière draws attention to the necessity for protecting native beneficial insects, and discusses the conditions governing the successful establishment of introduced species.

Under the sections dealing with the apparatus and materials employed in the control of agricultural pests, T. Ballu, in Les poudreuses (359–370 ; 221–226) discusses various types of dusting machines now in use in France, and calls for greater standardisation of models ; and Général Delcambre, in L'emploi de l'avion (371–379 ; 227–228), reviews the use of aeroplanes in the control of plant pests, which is at present limited in France to dusting infested forests, and suggests that it might be applied to vineyards. B. Trouvelot and M. Raucourt,

in Utilité de techniques standard pour l'appréciation de la valeur insecticide des composés antiparasitaires (383–391 ; 229–232), consider the problem of obtaining reliable comparative tests of the value of insecticides ; A. Boutaric, in Les mouillants, les adhésifs et les colloidaux (401–414 ; 251–258), discusses the physical properties of wetting agents, spreaders, etc. ; E. Blanchard and M. Amalbert, in Les insecticides et fongicides—règlementation de leur emploi—modifications à envisager (pp. 439–450 ; 269–280), demonstrate the necessity of modifying regulations governing the use of insecticides in France ; and F. L. Brancher, in La répression des fraudes dans le commerce des produits insecticides et fongicides (451–456 ; 281–287), insists on the immediate necessity of placing the sale of insecticides and fungicides under adequate legal restrictions. H. Decault, in Organisation administrative—législation et règlementation—réformes à envisager (459–470 ; 289–294), reviews the history of legislation governing plant pests in France ; and E. Blanchard, in Organisation professionelle—améliorations à y apporter (471–474 ; 295–297), demonstrates the need for collaboration among all the public services concerned in disseminating propaganda dealing with the control of pests, and suggests the formation of departmental syndicates having power to organise and enforce prompt action if a sudden outbreak of a pest occurs.

FAVARD (A.). **Contribution à l'étude de** *Cemiostoma scitella*, **Z., microlépidoptère nuisible aux arbres fruitiers.**—*Bull. Soc. Sci. nat. Rouen* (7) **66-67** (1930–31) pp. 121–124, 1 ref. Rouen, 1932.

The larvae of *Leucoptera* (*Cemiostoma*) *scitella*, Zell., a Tineid that occurs throughout Europe, mine in the leaves of pear [*cf. R.A.E.*, A **4** 19], apple and, more rarely, cherry, sometimes causing considerable damage in neglected orchards. Trees that are continuously attacked give poor yields of unsaleable fruit. In well tended orchards, infestation is generally unimportant. There are normally two generations a year in France, the mines being found chiefly in May–June and again in August. In October, mines of a partial third generation sometimes occur. The pupae hibernate. The moths fly during the sunniest hours of the day. One female lays about 12 eggs, singly on the lower surface of the leaves. The author obtained a Hymenopterous parasite from the mines.

Specifications for certain Insecticides and Fungicides.—*J. Minist. Agric.* **41** no. 3 pp. 225–228, 1 ref. London, June 1934.

These specifications have been prepared by the Association of British Insecticide Manufacturers, members of which (together with certain other firms) have agreed to conform to the standards here laid down. The insecticides included comprise lead arsenate, lime-sulphur, nicotine and nicotine sulphate, soft soaps used in sprays, sodium, potassium and calcium cyanides, and formaldehyde (formalin).

SMITH (K. M.). **The Mosaic Disease of Sugar-beet and related Plants.**—*J. Minist. Agric.* **41** no. 3 pp. 269–274, 3 pls., 5 refs. London, June 1934.

The symptoms of mosaic disease of sugar-beet are described and distinguished from the yellowing due to malnutrition. In England, the chief vector of the virus is *Aphis rumicis*, L. In experiments,

it was readily transmitted by *Myzus persicae*, Sulz. (the symptoms appearing 10–14 days after infestation), but not by *Macrosiphum solanifolii*, Ashm. (*gei*, auct.), *Lygus pabulinus*, L., or leafhoppers. Besides all the varieties of beet tested, mangel, spinach [*cf. R.A.E.*, A **21** 536] and *Chenopodium album* [*cf.* **19** 388] were found to be susceptible. The infection was transmitted to beet or *C. album* by rubbing the leaves with a pestle dipped in infected sap, the symptoms developing in 5–7 days. The development and spread of the disease in sugar-beet and mangel fields coincides with the appearance of winged migrants of *A. rumicis* in June and July. In September, winged sexual forms are produced, which migrate to *Euonymus* to lay overwintering eggs. The only known method of control is the suppression of weeds that may serve as food-plants of the Aphid and reservoirs of the virus.

Duchoň (F.). **Beitrag zur Frage der "Kleberpest" (Leimkleber) des Weizens.** [Contribution to the Question of the "Gluten Disease" in Wheat. (*In Czech.*)]—*Věstn. čsl. Akad. Zeměd.* **10** no. 4–5 pp. 261–265, 8 refs. Prague, 1934. (With a Summary in German.)

A deterioration of the gluten in wheat, involving depreciation of the quality of the flour, that has been observed in various parts of Europe is attributed by some investigators to a disease and by others to the injury caused by Pentatomids [*cf. R.A.E.*, A **22** 332]. In laboratory investigations in Prague, defective gluten was found in some of the samples of wheat that had been cultivated in plots treated with different fertilisers. A careful examination did not, however, reveal any trace of the characteristic injury known to be caused in Czechoslovakia by *Eurygaster integriceps*, Put., and *Aelia rostrata*, Boh. Comparative analysis showed that the deterioration is physiological and is brought about by a complex of adverse factors, which may include infestation by Pentatomids, drought, mildew or lack of nitrogen.

Manolache (C.). **Asupra unei invazii de *Anoxia villosa* Fabr. în Dobrogea (Coleoptera Melolonthini).** [On an Outbreak of *A. villosa* in the Dobrudja.]—*Bulet. Soc. Nat. Român.* 1934 no. 5 pp. 12–14, 3 figs., 9 refs. [Bucarest, 1934.] (With a Summary in German.)

Serious damage to the roots of various cereals and leguminous crops was caused in 1933 by larvae of the Melolonthid, *Anoxia villosa*, F., in a district of eastern Rumania, nearly 90 per cent. of the crops being destroyed over an area of about 5,000 acres. The number of larvae per sq. ft. averaged 2–3; most of them were infested by the Gamasid mite, *Coleolaelaps integer*, Berl. The adults, which are briefly described, appeared in July.

Chrzanowski (A.). **Beitrag zur Kenntnis der von Drahtwürmern—Elateridae-Larven herbeigeführten Beschädigungen von Kulturpflanzen.** [Contribution to the Knowledge of the Injuries caused to cultivated Plants by Wireworms.] [*In Polish.*]—*Choroby Roslin* **1** no. 3–4 pp. 52–62, 7 figs., 25 refs. Warsaw, 1931. (With a Summary in German.) [Recd. June 1934.]

Of the commoner species of wireworms recorded as injurious to cultivated plants, a list of which is given, those that have lately been

of frequent occurrence in Poland are *Lacon* (*Brachylacon*) *murinus*, L., *Corymbites* (*Selatosomus*) *aeneus*, L., *Limonius aeruginosus*, Ol., *Athous niger*, L., *Agriotes ustulatus*, Schall., *A. lineatus*, L., and *A. obscurus*, L., which last has been the most important. The greatest amount of damage is caused by the larvae in the third and fourth years of their life, when they readily migrate in the soil and require more food. The injury to young plants and to the seeds of spring-sown cereals is discussed. Infestation of beet is especially dangerous if it occurs soon after sowing, when the larvae attack the germinating seeds and later gnaw the radicles and the underground part of the young stems, killing the plants. In the more advanced plants with several leaves and a primary root about $\frac{1}{5}$ inch in diameter, the larvae attack the root near the top ; as a result, the plants wither and are easily severed from their base when hoed. The injury caused to older beet is less important, though the boring of the larvae in the tap root renders it susceptible to decay. It has been found that if they occur at the rate of 5–6 per sq. ft., they make the cultivation of any cereal or root crop impossible, and at a rate of 2–3 they greatly reduce the yield.

Field observations in eastern Poland in July 1929 showed that the larvae make their way into tomato stems, on the contents of which they feed, sometimes tunnelling as high as 20–24 in. The infested plants produce only a few small fruits, and the leaves twist, turn black and dry up. Often two or more larvae, usually of *A. obscurus*, occurred in a stem. A hop plantation in western Poland was seriously infested in May 1926, when *A. obscurus* and, in smaller numbers, *C. aeneus* attacked the newly planted slips, destroying the young shoots before they came to the surface.

Evidence has been secured that wireworms feed on the larvae and pupae of other insects, including *Euxoa* (*Agrotis*) *segetum*, Schiff., and on earthworms ; larvae of *A. obscurus*, *A. lineatus* and *C. aeneus* often attacked weak larvae of their own species at the time of moulting.

Krasucki (A.). **Die Hessenfliege** (*Mayetiola destructor* **Say**)**, Sattelmücke und Weizengallmücke in Südost-Polen.** [*M. destructor*, *Haplodiplosis equestris* and *Contarinia tritici* in south-eastern Poland.] [*In Polish.*]—*Choroby Roslin* **1** no. 3–4 pp. 72–75, 6 refs. Warsaw, 1931. (With a Summary in German.) [Recd. June 1934.]

Notes are given on the history of the occurrence in south-eastern Poland of *Mayetiola destructor*, Say, and *Contarinia tritici*, Kby., on wheat and rye, and *Haplodiplosis* (*Clinodiplosis*) *equestris*, Wagn., on wheat and barley. None of these Cecidomyiids is of great economic importance, outbreaks being rare and never very severe.

[Gradojević (M.).] **Градојевић (M.). Sur la présence des mâles de la cochenille :** *Eulecanium corni* **(Bouché) en Jougoslavie.** [*In Serbian.*]—*Rec. Trav. J. Georgevitch 60e Anniv.* pp. 115–125, 6 figs. Belgrade, 1933. (With a Summary in French.) [Recd. June 1934.]

An account is given of observations on the biology of the males of *Lecanium* (*Eulecanium*) *corni*, Bch., on plum in Jugoslavia [*cf. R.A.E.*, A **22** 195]. The young larvae are morphologically identical with the females from the time of hatching (in June) till after the moult (about

mid-April) following hibernation. The characters distinguishing the later stages are described. In the field, male larvae were often found in groups by themselves, but also occurred together with females, which they sometimes even exceeded in numbers. In the laboratory and in the field, the adult males were most abundant about the middle of May. Pairing has not been observed.

Gradojević (M.). **Suzbijanje skakavaca u Vojvodini u 1933 g.** [The Control of Locusts in Voivodina in 1933.]—*Glasn. Minist. Poljopr.* [*Bull. Minist. Agric.*] **12** no. 2 pp. 62–77, 7 figs. Belgrade, February 1934. [Recd. June 1934.]

Severe and increasing damage to crops in north-eastern Jugoslavia was caused in 1931 and 1932 by locusts [*Dociostaurus maroccanus*, Thnb.]. In July 1932, oviposition occurred over an area of about 74,000 acres, as many as 100 egg-pods (each containing 35–40 eggs) being found per sq. ft. in some places. A campaign organised by the Government was started early in May 1933, the principal measure being the use of brush-harrows drawn by two horses to destroy the young hoppers. Owing, however, to rather cold weather, hatching was protracted and the hoppers continued to appear over a period of about four weeks, so that harrowing had to be repeated several times in many instances. Over 5,000 horses were used in this work. Crops were protected by applying a spray of Urania green and lime, and much success was obtained with baits (of chaff, Urania green and molasses) about 14 tons of which were used. A survey in July showed that almost all the hoppers had been destroyed throughout the infested areas.

[Bugdanov (G. B.).] **Бугданов (Г. Б.). Species and Distribution of the Scale Insect Fauna (Coccidae) in the Eastern Foothill Zone of the North Caucasus.** [*In Russian.*]—10 pp. Ordzhonikidze, St. Zashch. Rast. gorsk. sel. khoz. Inst. [Plant Prot. Sta. Gorskiĭ agric. Inst.], 1933. (With a Summary in English.) [Recd. May 1934.]

This is a brief account of investigations on Coccids during June–August 1932 in an area to the west of Daghestan. The topography and type of vegetation are outlined. Separate lists are given of the 8 species found, showing their local distribution, food-plants and the parts attacked, and of the food-plants. The species concerned, most of which infested fruit trees, were: *Aspidiotus hederae*, Vall., *Coccus hesperidum*, L., *Lecanium* sp., *L. bituberculatum*, Targ., *L. corni*, Bch., *L. rufulum*, Ckll. (*pulchrum*, King), which was found on mulberry as well as oak, *Gossyparia* (*Eriococcus*) *spuria*, Mod. (*ulmi*, auct.) and *Lepidosaphes ulmi*, L. They chiefly occurred on old neglected trees.

[Radzievskaya (S. B.), Serbinov (V. I.) & Tzuigankov (S. K.).] **Радзиевская (С. Б.), Сербинов (В. И.) и Цыганков (С. К.). Pests and Diseases of Cotton. A Manual for Technical Schools.** [*In Russian.*]—Demy 8vo, 189 pp., 100 figs. Moscow, SAOGIZ [Amalgam. St. Pub. centr. Asiat. Sect.], 1934. Price 3 *rub.*

This handbook opens with a general account of the anatomy, morphology, classification, and biology of insects, and of the anatomy

and morphology of mites. About 50 pages are devoted to notes on the bionomics and control of the more important insects and mites that attack cotton in the Russian Union ; each species is described, and a key to the Aphids is included. Further notes are given on *Platyedra* (*Pectinophora*) *gossypiella*, Saund., and *Anthonomus grandis*, Boh., in view of the possibility of their introduction into the Russian Union, and the importance of quarantines against pests is briefly discussed. A section of 68 pages deals with various methods of control, spraying and dusting equipment, and the application of dusts from aeroplanes.

[Kosobutzkiĭ (M. I.).] **Кособуцкий (М. И.). The Results of our Method of checking the Dusting of Cotton Plants infested by** *Epitetranychus althaeae* **with Flower of Brimstone.** [*In Russian.*] —Large Cr. 8vo, 94 pp., 13 graphs, 5 refs. Tashkent, Uzbek. Otd. Aktz. Obshch. Bor'be Vred. sel. lesn. Khoz. [Pub. Uzb. Sect. Co. Contr. Pests Agric. For.], 1931. Price 2 *rub.* 50 *kop.* (With a Summary in English.) [Recd. June 1934.]

In view of the difference of opinion existing in the Russian Union as to the value of dusting with flowers of sulphur against the mite attacking cotton in Central Asia [*cf. R.A.E.*, A **19** 728 ; **21** 53, 161], which is here referred to as *Tetranychus telarius*, L. (*Epitetranychus althaeae*, v. Hanst.) [*cf.* **20** 619, etc.], large-scale field experiments were carried out in July and August 1930 in a number of districts in Uzbekistan. Formulae that were used in checking the results of applying the dust are discussed, based on the observation that there is a practically constant relation between infestation, foliage injury and crop loss. As there are considerable natural fluctuations in the rate of increase of the mites, the immediate mortality obtained is not a true criterion of the ultimate value of treatment. Counts of reddened leaves, which represent the final, not the initial, result of the feeding of the mites, also give unreliable results. The value of sulphur dust is limited by its failure to protect the upper rows of bolls, which produce the better quality of cotton but are those most often shed by infested plants. At the best, dusting appears only to retard the increase of infestation, though the ultimate loss of crop is less than in the untreated fields. It is possible that it may ultimately be replaced by agricultural measures based on a fuller knowledge of the food-plants of *T. telarius* and its methods of spread. On the other hand, though it is not at present economically justifiable, improvement in the technique of application and the addition of other substances to the sulphur may change the situation. Irrigation of dusted fields should be made obligatory [*cf.* **19** 728 ; **20** 391 ; **21** 161].

Bliss (C. I.). **The Method of Probits.**—*Science* **79** no. 2037 pp. 38–39, no. 2053 pp. 409–410. New York, 1934.

The result of an investigation of the action of a toxic agent on the mortality of an organism is usually expressed as an asymmetrical S-shaped curve in which percentage mortality is related to dosage. The author describes a method for converting this curve into a straight line by using as abscissae the logarithms of the dosages and as ordinates the percentage kills expressed as arbitary probability units (called probits) adapted from tables of the probability integral. This type

of presentation allows of an increased accuracy in calculating dosage-mortality curves and in interpolating dosages from such curves over a more extended range of mortalities than has hitherto been practicable. In addition, it serves as a test of the proposed theory of toxic action that variation in susceptibility among individuals is normal and that the effectiveness of the dose increases as its logarithm, and affords a simple method of expressing, in the slope of a straight line, the relative uniformity or diversity between individuals in their susceptibility to a poison. It also renders possible a closer scrutiny of experimental technique to determine if the organisms exposed to each dosage were truly equivalent and if the amounts administered experimentally were uniformly proportional to the effective dosage over the entire range covered by the experiment ; and the disclosure of change in the mode of lethal action with certain poisons over different sections of the dosage range, indicated by an abrupt change in slope.

Records from the literature to which this theory has been applied successfully include such diverse cases as the action of nicotine sprays on Aphids, of several fumigants on adults of *Tribolium*, of hot water on pupae of the Japanese beetle [*Popillia japonica*, Newm.], of X-rays on eggs of *Drosophila* and of acid lead arsenate on larvae of the silkworm [*Bombyx mori*, L.].

The Plant Pest and Disease Regulations, 1933. Government Notice no. 59.—*Tanganyika Terr. Gaz.* **14** no. 21 Suppl. pp. 57–58. Dar-es-Salaam, 21st April 1933. [Recd. July 1934.]

Provision is made for enforcing the removal and destruction by landowners in Tanganyika Territory of *Oxyanthus speciosus*, *Randia* sp. and *Vangueria* sp. [which are food-plants of the coffee stem-borer, *Anthores leuconotus*, Pasc. (*R.A.E.*, A **21** 364)].

CHATTERJEE (N. C.). **Entomological Investigations on the Spike Disease of Sandal (19). On the Life-history and Morphology of *Petalocephala nigrilinea* Walk. (Jassidae, Homopt.).**—*Indian For. Rec.* **19** pt. 9, 30 pp., 2 pls., 25 refs. Delhi, 12th April 1934. Price 1*s.* 3*d.*

Petalocephala nigrilinea, Wlk. [*cf. R.A.E.*, A **21** 364], of which *P. uniformis*, Dist. [**20** 373, 539 ; **21** 363] and *P. bombayensis*, Dist., are synonyms, the species showing variations in colour and markings, is one of the commonest Jassids attacking healthy sandal (*Santalum album*) and that affected with spike disease in southern India. It is known to breed on six other shrubs or trees. The removal of the sap from the leaves by the nymphs, and from the shoots by the adults, checks the growth and may cause the death of the foliage, young shoots and twigs. Shoots that are not killed develop in about 3 weeks small and clustered leaf-buds, which appear as if diseased. An unhealthy " hopper-burn " condition results from severe infestation of the terminals. The vitality of the shoots is further reduced by the oviposition slits made across the axis, scars from which were found on 15 per cent. of the trees, including diseased ones, in a small area. *P. nigrilinea* is the principal cause of thin crowns and stag-headedness in sandal forests [*cf.* **22** 14, 165].

In the laboratory, the nymphal period averages 102 days. Pairing occurs within 12–15 days of the last moult, and oviposition begins

after another 10–20 days, being repeated at intervals of 5–7 days after further pairing. The eggs, of which 7–9 are laid in each slit, hatch in 27 days. One female made 15 slits. The adults live for over 3½ months, and there are three overlapping generations a year, which in the laboratory developed during January–April, May–August and September–December. As the interior ovipositor lobes of females that had completed oviposition were coated with a layer of plant tissue, mechanical transmission of spike disease may take place, but transmission experiments here described were inconclusive.

Descriptions are given of the various stages and of the development of the tibia, tarsus and female genitalia. A key is included to the nymphal instars, the duration of which is discussed.

Dover (C.) & Appanna (M.). **Entomological Investigations on the Spike Disease of Sandal (20). Studies on Insect Transmission.**—*Indian For. Rec.* **20** pt. 1, 25 pp., 3 pls., 10 refs. Delhi, 12th May 1934. Price 2*s*.

In investigations on the possible transmission of spike disease of sandal (*Santalum album*) by insects in southern India, mass infection experiments and tests with groups of insects were unsatisfactory, partly owing to the defectiveness of the technique, which is described. In individual tests, which are tabulated, negative results were obtained with 29 species of Rhynchota, including *Petalocephala nigrilinea*, Wlk. [*cf.* preceding paper] and 6 of the 7 previously suspected of being vectors [*R.A.E.*, A **22** 311], and 6 of Coleoptera. Symptoms produced on 5 out of 36 plants by the feeding of *Moonia albimaculata*, Dist., however, appeared indistinguishable from those of the disease. These symptoms, together with biological considerations and the results of analyses of the nitrogen and starch content of the leaves, led to the conclusion that the plants were infected, which was further supported by the determination of characteristic cytological features of the disease. One plant developed symptoms closely resembling those of the disease after the feeding of Aphids of the genus *Macrosiphum* taken from *Lantana*. These Aphids are extremely rare on sandal in the field, but it is significant that the presence of *Lantana* is always associated with a high incidence of the disease and that primary attacks are invariably recorded from areas adjacent to agricultural lands, where Aphids are frequently common.

In an addendum, C. F. C. Beeson states that the Board for the Sandal Spike Investigations is not wholly agreed that the available evidence demonstrates conclusively that spike disease has been experimentally transmitted by insects.

Wagle (P. V.). **The Mango Hoppers and their Control in the Konkan, Bombay Presidency.**—*Agric. Live-Stk India* **4** pt. 2 pp. 176–188, 2 pls., 14 refs. Delhi, March 1934.

All the three species of *Idiocerus* known to attack mango in India occur in the Konkan (Bombay Presidency), where it is extensively cultivated, but *I. clypealis*, Leth., is more injurious than *I. niveosparsus*, Leth., or *I. atkinsoni*, Leth. In some years the injury [*cf. R.A.E.*, A **18** 444] is estimated to cause a loss of 60 per cent. of the crop. In the course of studies carried out in 1926–31, it was found that the egg stage of all three species averaged 4–6 days and the

nymphal 10–13. *I. atkinsoni* and *I. niveosparsus* have three generations a year (the immature stages occurring in June, October and January–March), whereas *I. clypealis* has only one (in January–March). The mango usually flowers in two or three distinct flushes in this area, but the January flush is much the heaviest and the most severely damaged. During June and October the Jassids breed on vegetative shoots, and from November onwards on flower-shoots. All species pass the remainder of the year in the adult stage on the stems and leaves of mango ; no alternative food-plants are known. The eggs are laid singly in the mid-ribs of leaves, calyces of flower-buds or rachis of inflorescences, or later in the season in the fruits themselves [*cf.* **21** 550]. Nymphs of all ages as well as adults feed on the buds and tender shoots. The Jassids shun sunlight but have been observed to fly as far as 200 ft. Two natural enemies [*cf.* **10** 218], the Lepidopterous parasite, *Epipyrops fuliginosa*, Tams, and a Dryinid, are present in Konkan, but do not appear to exercise any appreciable control.

Sprays of fish-oil resin soap proved uneconomic, as they killed only the nymphs and 5–6 applications were required [*cf.* **21** 551]. Bordeaux mixture was cheaper and an effective deterrent, besides controlling mildew, but a combination of the two was unsatisfactory. Sulphur dust (2–3 applications at intervals of 2 weeks), which killed the nymphs, repelled the adults and controlled mildew, was the most profitable treatment, the average cost per 1,000 flower-heads being about 1*s.* 4*d.* and the net profit about 7*s.* 6*d.* Combinations of sulphur with calcium cyanide dust "A" [*cf.* **15** 173] (6 : 1) or with tobacco dust (5 : 1) were no better than the sulphur alone. Treatments applied when the Jassids were not breeding did not prove successful.

King (C. B. R.). **Report of the Entomologist for the Year 1933.**—*Bull. Tea Res. Inst. Ceylon* no. 11 pp. 26–30. Kandy [1934].

The percentage of eggs of *Ephestia* [*kühniella*, Zell.] that gave rise to adults in the laboratory in Ceylon was raised from 3–4 to 9–10 when ½ oz. each of Marmite and cod-liver oil [*cf. R.A.E.*, A **21** 405] was added to every 5 lb. of the sterilised meal used in rearing this moth as a host for *Trichogramma*. By scattering the eggs over a thin layer of the meal and adding the remainder after the larvae had become established, congestion at the surface and migration of larvae from the meal before they were full-grown were prevented. The parasites reared during the year from Limacodid tea pests have already been noticed [**19** 573 ; **20** 498]. Species recorded as parasites of Psychids on *Albizzia* and tea [*cf.* **21** 405] include *Mesostenus* sp. and *Sympiesis* sp. from *Clania crameri*, Westw. The shot-hole borer [*Xyleborus fornicatus*, Eichh.] has spread southwards, but it is not likely to become a serious pest of tea in the districts invaded. It was also found attacking *Grevillea*.

Chu (Joo-tso). **Investigations on the Life History of the Mulberry Geometrid, *Hemerophila atrilineata* Butler.** [*In Chinese.*]—*Tech. Bull. Bur. Ent. Chekiang* no. 10 ; also in *Chekiang Agric.* **1** no. 3 pp. 7–42, 11 figs., 14 refs. Hangchow, October 1933. (With a Summary in English.) [Recd. June 1934.]

The Geometrid, *Hemerophila atrilineata*, Butl., is widely distributed in eastern China, where it has four generations a year and frequently causes serious damage to the buds and leaves of mulberry trees. At

the end of October, larvae of the fourth or fifth (final) instar shelter for hibernation in cracks in the trunk or under the bases of the branches; they resume activity after about six months, when the temperature reaches 60°F. in spring, and attack the buds. The pupal period is passed in greyish brown cocoons in crevices or folds of the leaves and lasts 13–20 days for the first generation, 7–12 for the second and third and 10–15 for the fourth. The moths usually emerge in the evening, pair after midnight and oviposit the next day on the lower surface of the leaves. One female lays about 700 eggs. The larvae hatch in 4–8 days and skeletonise the leaves, the larval stage lasting a month or less according to the temperature. The earliest, latest and average dates of the occurrence of each stage in 1929–30 are tabulated. The Braconid, *Rhogas japonicus*, Ashm., is an endoparasite of the larvae.

In the winter of 1930–31, about 92 per cent. of the hibernating larvae were caught in bands of rice straw fixed round the tree trunks [*R.A.E.*, A **22** 127].

Li (Feng-swen). **The Life History and Control Measures of the Cotton Leaf-roller,** *Sylepta derogata* **Fabricius.** [*In Chinese.*]—*Tech. Bull. Bur. Ent. Chekiang* no. 12; also in *Chekiang Agric.* **1** no. 3 pp. 73–98, 6 figs. Hangchow, October 1933. (With a Summary in English.) [Recd. June 1934.]

Investigations were undertaken in Nantung in 1930 and Shanghai in 1931 on *Sylepta derogata*, F., which attacks various malvaceous plants, including cotton, on which it is most injurious in September and October. The greatest damage is caused near mountains, houses or trees, where there are large areas of shade. One female lays over 200 eggs. Four generations probably developed in 1931, the egg stage lasting 3 days, the larval 22 and the pupal 8. The mature larvae of the last generation overwinter. Nine species of Hymenopterous parasites were obtained from this Pyralid, eight from the larvae and one from the pupae. Up to 55 per cent. of the larvae were attacked by one Chalcid, which had a life-cycle of about 20 days or more at Nantung. A total of 1–66 and an average of 11 individuals of this Chalcid develop in a single host.

Measures recommended are: early planting of cotton; clean cultivation; the use of light-traps for the moths; the application of sprays against the larvae of 2 lb. Paris green, 3 lb. lime and 150 gals. water or 2 lb. lead arsenate, 6 lb. soap and 25 gals. water; and the protection and encouragement of parasites.

Li (Feng-swen). **The Life-history and Control Measures of the Cotton Geometrid** (*Boarmia sp.*). [*In Chinese.*]—*Tech. Bull. Bur. Ent. Chekiang* no. 13; also in *Chekiang Agric.* **1** no. 3 pp. 99–110, 1 fig. Hangchow, October, 1933. (With a Summary in English.) [Recd. June 1934.]

In 1919, *Boarmia* sp. caused serious injury to cotton over an area of about 67 sq. miles in a coastal district of Kiangsu. In 1931, this Geometrid had 5 generations in the field, the larvae pupating in the soil. The females from overwintered pupae had an oviposition period of 1–5 days and the others of $2\frac{1}{2}$–$5\frac{1}{2}$ days, the number of eggs laid

averaging 1,109 and 220 respectively. Control measures recommended are : deep ploughing between November and April ; intensive cultivation during the cotton growing season ; crop rotation with wheat and rice for 2 or 3 years ; protection of beneficial animals, especially frogs ; and the use of light-traps before the oviposition periods.

LABOISSIÈRE (V.). **Chrysomelidae nouveaux de l'Indochine et de la Presqu'île de Malacca.**—*Ann. Ass. Nat. Levall. Perret* **20** pp. 130–142, 4 figs. Levallois-Perret, 1932.

Correction.—*Malayan agric. J.* **22** no. 5 p. 244. Kuala Lumpur, May 1934.

The Galerucid, *Craniotectus corbetti*, gen. et sp. n., described in the first paper from Malaya, is stated in the second to be the pest of *Derris* tentatively identified as *Neolepta biplagiata*, Jacoby [*R.A.E.*, A **19** 139, 194].

Studies on the Control of Rice Borers.

OKADA (J.), MAKI (T.) & KURODA (H.). **I. Observations on the Liberation of some Hymenopterous Parasites living in the Eggs of the Rice Borer** *Chilo simplex* **Butler.** [*In Japanese.*]—*Nojikairyoshiryo* no. 69 [2] 2, 78 pp., 1 pl., 2 figs., 28 graphs. Tokyo, Minist. Agric. Japan, February 1934. (With a Summary in English.)

OKADA (J.) & MAKI (T.). **II. Biological Studies on** *Phanurus beneficiens* **Zehntner, a Hymenopterous Egg-parasite of the Rice Borer,** *Chilo simplex* **Butler.** [*In Japanese.*]—*T.c.* [2] 42, 4 pp. (With a Summary in English.)

In the first paper, it is stated that the practice of collecting the egg-masses of *Chilo simplex*, Butl., from rice plants in Japan, while it was found not to reduce infestation appreciably, destroys large numbers of efficient Hymenopterous parasites, of which the commonest are *Trichogramma japonicum*, Ashm., and *Phanurus beneficiens*, Zhnt., the former being the more widely distributed. During 1926–31, the supply of these parasites was augmented by placing parasitised egg-masses in breeding jars in the field. Their effectiveness was noticeable in the first generation of the host when it was relatively scarce. Parasitism was markedly increased within 70–80 yards of the breeding jars, and the injury to rice was reduced. The effectiveness of liberation was influenced by the direction of the prevailing wind.

The studies described in the second paper showed that *P. beneficiens* has about 8 or 9 generations a year in southern Honshu and is most abundant in late spring and early summer. Maximum emergence of the adults occurs from 5 to 7 a.m., the males tending to emerge slightly earlier than the females. The latter generally form about two-thirds of the total, but more males emerge from eggs laid at the beginning or end of the oviposition period. Pairing takes place on or near the eggs from which the parasites have emerged, and the males are polygynous. This Scelionid does not parasitise the other rice-borer, *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.).

Females lay more eggs on the day of emergence than on any subsequent day. Parasitism is higher in the interior of fields of rice seedlings than on the borders, and egg-masses on the upper parts of the plant are more often attacked. The number of adult offspring from one female varied from 45 to 275, with an average of 143. Adult life averaged 15–16 days in summer, with a maximum of over a month. The adults

hibernate, apparently among withered grass. The optimum conditions for development are a temperature range of 25–30°C. [77–86°F.] and a relative humidity of 75–80 per cent. The parasites survived immersion of the parasitised eggs in water at about 20 and 30°C. [68 and 86°F.] for 5 and 3 days respectively.

RAFF (J. W.). **Notes on Silver-fish.**—*Vict. Nat.* **50** no. 5 pp. 111–115. Melbourne, September 1933.

The species of silverfish most commonly found in houses near Melbourne is *Ctenolepisma lineata*, F., though *Lepisma saccharina*, L., and *Thermobia aegyptiaca*, Luc., also occur. Numbers of *C. lineata* were confined in two glass beakers at room temperature in a closed tin, which also contained a vessel of water. They were fed on powdered starch, artificial silk, brown paper smeared with bookbinder's paste, blotting paper and tissue paper, and one individual in each beaker was still living at the end of two years. These two insects were then placed in separate beakers and given the same diet with the addition of a pinch of casein, and both were alive after a further 20 months. Artificial silk appeared to be the preferred food. Pure unsoiled woollen or silk fabrics were not attacked. The numbers of the sexes appeared to be about equal. The eggs were dropped loosely among the food materials and hatched in 6–9 weeks. The greatest number laid by one female was 25 over a period of 10 days in March.

The so-called house centipede (*Scutigera*) readily fed on silverfish in captivity, one individual eating 14, as well as a few flies, in one month.

NEWMAN (L. J.) & O'CONNOR (B. A.). **Green Tomato Bug.**—*J. Dep. Agric. W. Aust.* (2) **11** no. 1 pp. 101–112, 8 figs., 2 refs. Perth, W.A., March 1934.

All stages are described of *Nezara viridula*, L., which has recently become a serious pest on a large variety of plants in Western Australia [*cf. R.A.E.*, A **21** 678]. The eggs are laid on the lower surface of the leaves [*cf.* **22** 266], usually in clusters of 30–90. In 1932 they were first found in the field on 22nd September, and hatched on 11th October. The incubation period in November was 11–12 days and in February 5–7. During November–January and March–May, the time required for development from egg to adult, including five nymphal instars, varied from about 9 to 20 weeks with an average of 14. There are probably only three generations a year in the field. In 1932, pairing was first observed in the laboratory on 29th July and in the field on 3rd August. The adults hibernate under bark and débris; the majority turn a greenish brown [*cf.* **22** 678] and probably die, whereas those that retain their green colour and feed during fine periods may survive until spring. Fifth-instar nymphs were also active during fine winter weather, and probably overwintered. The adults live some months, and each female may lay several egg-masses. Beans are the preferred food-plant. Tomatos are severely damaged, but in the laboratory the nymphs failed to develop on them unless they were bearing fruit. Various contact insecticides [*cf.* **14** 364; **21** 678] are recommended for control. The parasite, *Microphanurus megacephalus*, Ashm. [*cf.***20** 106] has been introduced from Egypt and reared in large numbers for distribution. Egg-masses of the Pentatomid, which must not be

advanced in development, are subjected to parasitism in breeding cages for 4–5 days and then sent by post to growers, who are instructed to pin them to the lower surface of leaves on infested plants, taking care not to leave them exposed to direct sunlight. It is not known whether this Scelionid will survive the winter. Its life-cycle from egg to adult occupies 9–10 days.

SWAN (D. C.). **A Scarab Beetle (*Aphodius tasmaniae* Hope) destructive to Pastures in the south-east of South Australia.**—*J. Dep. Agric. S. Aust.* **37** no. 9 pp. 1149–1156, 6 figs., 3 refs. Adelaide, 16th April 1934.

Aphodius tasmaniae, Hope, seems to have increased in numbers in the south-eastern part of South Australia during the recent period of agricultural development, and its larvae now cause damage in pastures in certain districts. They live in vertical burrows, emerging at night to move about the surface and biting off pieces of leaves of the pasture plants, on which they subsequently feed. In areas where infestation is severe, enough earth is thrown out of the burrows to cover the young growth, resulting in bare patches if this occurs in winter. In April 1933, the number of burrows in an infested area was estimated at 150 per sq. ft.

The adult of this Aphodiid is described. The life-cycle apparently occupies about a year. The adults after emerging from pupae in the soil remain quiescent for some days. No oviposition was observed by beetles kept in the laboratory for a fortnight after emergence, although pairing occurred freely. Dissection of ovaries at the end of this period suggested that only about 20 eggs are laid by each female. Pairing flights always take place on warm and humid nights, the first in 1934 being observed in the Mount Gambier district on 21st February, or about a fortnight later than in the four preceding years, with a similar flight on 7th March. The beetles are attracted to lights and are so numerous as to make it difficult to drive a car among them at night. It has been suggested that females select areas specially rich in dung for oviposition, so that heavy infestations may be expected near fences or at other spots where sheep tend to congregate. In infested pastures that have been examined, subterranean clover (*Trifolium subterraneum*) comprised up to 80 per cent. of the vegetation, the remainder being chiefly annual grasses. The soil was sandy, facilitating burrowing.

The larvae apparently hatch after the onset of the autumn rains, when the moisture content of the soil has become adequate. They continue to feed throughout the winter and are full-grown about September, when they are usually found in their burrows at a depth of about 6 inches awaiting pupation. No natural enemy of importance was seen in the field, but in some places 5–20 per cent. of the full-grown larvae were killed by a fungus. The larvae may also be found in areas newly planted with cereals and are troublesome on golf links. They are seldom present in the same situation for two consecutive years, and an interval of several years may intervene between successive infestations. The thorough turning over of the soil by the larvae has sometimes been found to improve its fertility in the following year. In 1934 the first pupae were found at the beginning of January at the bottom of the larval tunnels, lying in terminal rounded cells. The first adults were taken on 15th January, but the majority generally emerge early in February if conditions are favourable.

Control measures over wide areas are impracticable. A spray of 7 lb. lead arsenate to 100 gals. water gave effective control in golf greens. This method, however, is costly and renders pasture unfit for grazing. As the larvae and pupae succumb to heat and drought, deep cultivation in early summer should cause heavy mortality, and similar treatment of newly infested pastures in hot, dry weather should destroy many of the young larvae.

DAVIDSON (J.). **The "Lucerne Flea" *Smynthurus viridis* L. (Collembola) in Australia.**—*Bull. Coun. sci. industr. Res. Aust.* no. 79, 66 pp., 5 pls., 28 figs., 2 pp. refs. Melbourne, 1934.

Much of this information on the bionomics and control of *Smynthurus viridis*, L., in Australia, has already been noticed [*R.A.E.*, A **22** 61 ; etc.]. A series of maps illustrates the actual and potential distribution [*cf.* **21** 521] in Western and South Australia, where its range as a pest is not likely to be further extended, and in Victoria and Tasmania, and its potential distribution in New South Wales, from which it has not been recorded. All the eggs were destroyed in some laboratory tests by fumigation with carbon bisulphide (0·4 cc. per 3,000 cc. volume for 25 hours) or hydrocyanic acid gas (2·5 mg. to 10 cu. ft. for 17 hours or 3·75 mg. for 3 hours). Fumigation with carbon bisulphide did not effect the germination of seed of lucerne or of subterranean clover (*Trifolium subterraneum*).

EVANS (J. W.). **Thrips Investigation. 2. Some Factors that regulate the Abundance of *Thrips imaginis* Bagnall.**—*J. Coun. sci. industr. Res. Aust.* **7** no. 2 pp. 61–69, 2 figs., 1 ref. Melbourne, May 1934.

In conjunction with observations on the seasonal abundance of *Thrips imaginis*, Bagn., in the neighbourhood of Adelaide [*R.A.E.*, A **20** 601 ; **22** 60], daily records have been kept for two years of the populations present in roses, and, during the spring, in flowers of *Cryptostemma calendulaceum* and *Echium plantagineum*. The purpose of this paper is to present evidence that the weather during autumn and winter largely determines the magnitude of the initial spring population and hence the possibilities of an infestation. The data accumulated show a close correlation between the autumn and spring populations of *T. imaginis* and demonstrate how the increase and decrease of the population is directly dependent upon meteorological conditions.

Experiments on the effects of different degrees of soil moisture on the pupal stage of *T. imaginis*, in which it is least resistant to climatic influences, were carried out in the spring of 1933. Fully matured nymphs were transferred to flower-heads of *Plantago lanceolata*, and the stalks of the plants were embedded in soil contained in circular cells excavated in large corks. A cotton-wool wick passed from the base of each cell to the bottom of the cork, and each cork was fitted into the base of a glass lamp-chimney, the top of which was covered with cellophane. Water was added to the soil by placing the corks in dishes of water. As soon as the surface was evenly wet, the soil was considered to be saturated and the containers were placed in a soil-temperature tank. After 24 hours the plants, with any thrips that had not entered the soil, were removed. At 21·5°C. [70·7°F.], the emergence of adults lasted from the 7th to the 11th day. At least 3 days elapsed from the time the nymphs entered the soil until they became prepupae, 1 day

was spent in the prepupal stage and a minimum of 2 in the pupal stage. Comparative tests with air-dry soil and with soil saturated daily and also at intervals showed that the greatest emergence resulted when the soil was wet on the day the nymphs entered the soil and on the 6th day, just before the emergence was due. The moisture of the saturated soil was 26 per cent. and that of the air-dry soil 3 per cent.

Population records showed that during 1932 the autumn weather allowed an increase of *T. imaginis* during two successive generations. The winter weather was favourable and in spite of a cold wet spring the numbers of thrips rose in September. In 1933, only a short period of conditions suitable for reproduction occurred in autumn and such increase as did result was largely dissipated as the result of premature emergence during a period of warm dry weather in winter (July). Consequently, although October was hot and dry, conditions usually associated with infestation, the numbers of thrips present during the spring months were negligible.

One of the factors responsible for the great abundance of thrips during the spring of 1931 was the rainfall at the end of the preceding summer (1 inch was recorded on 12th March). Several days of light rain at the end of the summer will have little effect on the moisture of the soil, but a heavy fall during a short period will increase the soil moisture considerably. It is therefore possible that during the autumn of 1931 moisture conditions permitted favourable development of three generations as compared with two in 1932 and only one in 1933. Further study may show that favourable weather during one year only is not sufficient to induce infestation.

Wheeler (H. W.). **Thrips Investigation. 3. Some Observations on the Loss of Toxicity of certain Dusts used in Experiments on the Control of the Apple Thrips** (*T. imaginis* **Bagnall**).—*J. Coun. sci. industr. Res. Aust.* **7** no. 2 pp. 70–72, 2 refs. Melbourne, May 1934.

Preliminary experiments have been made with pyrethrum and derris dusts exposed to light for different periods to determine their toxicity to *Thrips imaginis*, Bagn., and the relation between their toxicity and chemical composition. Both materials lose strength on exposure, sunlight being the chief factor causing deterioration. To be satisfactory for the control of the thrips on apple trees, a dust must remain active after two days' exposure.

Small quantities of pyrethrum having a known content of pyrethrin I [*cf. R.A.E.*, A **20** 37] were exposed to sunlight for definite periods and the amount of pyrethrin I remaining after the period of photo-chemical decomposition was estimated in each case. Samples containing varying percentages of pyrethrin I were tested by placing one apple blossom bud, dusted with the powder, in a tube with 35 females of *T. imaginis*. After 24 hours the numbers of thrips repelled and killed were counted. The relation between content of pyrethrin I and duration of exposure shows that the rate of deterioration is approximately proportional to the concentration for about 8 hours. After this the rate of photo-chemical action falls off, and the powder contains an appreciable amount of pyrethrin I even after 45 hours. The insecticidal activity of the powder diminishes as the time of exposure increases, and the pyrethrin I content gives an approximate estimate of the toxicity of the deteriorated powder. The sample exposed for 25

hours, which is roughly equivalent in properties to a dust that has remained on a fruit tree for 3 days, still had a marked repellent action on the thrips. The pyrethrin I content of a sample exposed to ordinary daylight in the laboratory for 25 hours was equivalent to that of one exposed to bright sunlight for 2 hours.

Rotenone and the related constituents of derris lose their toxicity on exposure to light, but at a much slower rate than do the pyrethrins, the reaction being apparently one of photo-chemical oxidation. Rotenone was not so effective against *T. imaginis* as an equivalent amount of pyrethrin I, but derris dusts containing a comparatively high percentage of rotenone gave favourable results. In comparative tests with a fresh sample of a commercial dust containing crushed derris root, barium fluosilicate and sulphur, and one that had been exposed to bright sunlight in a thin layer for 25 hours, the rotenone content decreased from 1·5 per cent. to 0·9 per cent. The fresh and exposed samples caused 99 and 65 per cent. mortality of the thrips respectively.

TUCKER (R. W. E.). **Insects in Houses in Barbados.**—*J. Barbados Mus. hist. Soc.* **1** no. 2 pp. 73–79. Bridgetown, February 1934.

The cockroaches, *Periplaneta americana*, L., *P. australasiae*, F., and *Blattella germanica*, L., are the most prevalent insect pests in houses in Barbados. They are best controlled by dusting with sodium fluoride, but a mixture of equal parts of borax and powdered sweet chocolate is a useful bait. Other insects include the cricket, *Amphiacusta caribbea*, Sauss., which can also be controlled with sodium fluoride dust, and the Anobiids, *Lasioderma serricorne*, F., and *Sitodrepa panicea*, L. To destroy larvae and eggs of these beetles, such infested articles as are suitable should be submitted for 1–2 hours to a temperature of 140°F. To protect books on open shelves, the inside of the covers and the binding creases should be painted with 1 oz. mercury bichloride in 2 pints methylated spirit to which $1\frac{1}{2}$ oz. pure carbolic acid or wood creosote, or 3 or 4 naphthalene balls have been added. When this has dried, a coating can be given of 1 oz. shellac in 8 oz. methylated spirit to which has been added a little creosote.

EDWARDS (W. H.). **Pests of Bananas in Jamaica.**—*Ent. Circ. Dep. Sci. Agric. Jamaica* no. 14, 20 pp., 11 pls., 12 refs. Jamaica, 1934.

Insects that occur on bananas in Jamaica include *Aonidiella* (*Chrysomphalus*) *personata*, Comst., *Pentalonia nigronervosa*, Coq., and *Metamasius sericeus*, Ol. (brown weevil borer), but *Cosmopolites sordidus*, Germ., is the only one that can be considered a pest. This weevil, the bionomics of which are briefly described, was probably introduced when the first banana plants were imported many years ago, and it has now been recorded from all parts of the Island. It is under complete control where a high standard of cultivation is practised, but is still abundant where bananas are not grown intensively [*cf. R.A.E.*, A **18** 615]. Infestation has increased in several districts since 1933, mainly as a result of the last hurricane, which blew down many trees and was followed by a drought that reduced the vitality of the remainder. Ideal breeding conditions for the weevil have also been provided in fields abandoned on account of Panama disease, etc.

Financial loss may be caused when suckers newly planted in previously infested fields are killed before they have developed sufficiently

strong root systems to build new tissues faster than the rate of destruction by the larvae, or when the vitality and yield of the plants are reduced by extensive tunnelling of the corms. Plants grown in fertile soil under favourable atmospheric conditions are relatively resistant. The effects of infestation are accentuated during protracted drought.

Suckers should be dug only one day before planting, cleaned and examined [*cf.* **19** 694]. They should not be left overnight near infested fields, and if they are transported, no packing material from infested fields should be used and all such material should be burnt on reaching the destination. Treatment with insecticides is very difficult. Hand-collection of adults on a large scale gives satisfactory results, especially as they are readily attracted to baits [*cf.* **16** 533]. Stems from which bunches have been reaped should be rendered unsuitable for the weevil by cutting them in such short pieces that they will decompose completely within 3–4 weeks. When heavy infestations have to be controlled, spent stems should be cut to within 6 inches of the ground ; the remaining portion should be split to the ground, and the cut surfaces and corm dusted with Paris green. From time to time, the older tissues should be removed and destroyed so far as possible without injuring the younger shoots. The soil should be banked up round the crowns of the stems so that the root origins are not exposed, and all plant refuse in the neighbourhood of the stools should be removed and buried. A survey showed that, wherever severe infestations occurred, measures had been applied faultily or not at all.

Attempts in 1918 and 1919 to establish *Plaesius javanus*, Er., a parasite of *C. sordidus* in Java, were unsuccessful [**18** 616]. Although the earwigs, *Psalis americana*, P. de B., and *Anisolabis annulipes*, Luc., prey upon the larvae in Jamaica, their diet is not restricted to them, and as they are never found in large numbers they are not likely to be of importance in control.

PINTO DA FONSECA (J.). **Insectos e acarinos productores de manchas e lesões nos frutos citricos.** [Insects and Mites producing Spots and Lesions in Citrus Fruits.]—*Bol. Agric.* **33** (1932) pp. 516–577, 38 figs. S. Paulo, 1933. [Recd. June 1934.]

Notes are given on the bionomics and control of a number of insects and mites that injure the fruits of *Citrus* in São Paulo, Brazil, most of which have already been noticed [*R.A.E.*, A **20** 403]. Many original figures are included.

HARTZELL (A.). **Histopathology of Insect Nerve Lesions caused by Insecticides.**—*Contr. Boyce Thompson Inst.* **6** no. 2 pp. 211–223, 6 figs., 21 refs. Yonkers, N.Y., 1934.

The following is taken from the author's summary : Nerve lesions have been found in mealworm larvae (*Tenebrio molitor*, L.) and adult grasshoppers (*Melanoplus femur-rubrum*, DeG.) that had been killed by pyrethrum concentrates applied externally [*cf. R.A.E.*, A **21** 193 ; etc.]. The technique employed was that used in the detection of paralysis in man, which involves the use of toluidine blue. Lesions were found throughout the main parts of the central nervous system, in the brain, the sub-oesophageal ganglion, thoracic ganglia, abdominal ganglia, and connectives. From a study of the histopathology of the

nerves, it is concluded that death is caused by the destruction of the cells of the central nervous system accompanied by paralysis. No comparable destruction of nerve tissue was found in examples of these species killed by rotenone, but lesions were found in the central nerve ganglia of larvae of *T. molitor* killed by triorthocresyl phosphate.

Larvae of *T. molitor* killed by exposure for two minutes in a high frequency field of approximately 300 million cycles (or 1 metre) and 2·9 ampères showed nerve lesions unlike those produced in larvae killed by heat (52°C.) applied externally.

LATTA (R.). **A Note on the Distribution of *Eumerus narcissi* Smith (Diptera : Syrphidae).**—*Proc. ent. Soc. Wash.* **36** no. 4 p. 80. Washington D.C., April 1934.

A single male of *Eumerus narcissi*, Smith, was found on flowers near a bed of daffodils in Iowa during 1933 [*cf. R.A.E.*, A **21** 345].

BUCHANAN (L. L.). **A new North American *Magdalis* from Blue Spruce (Coleoptera : Curculionidae).**—*Proc. ent. Soc. Wash.* **36** no. 4 pp. 85–87, 1 fig. Washington D.C., April 1934.

Magdalis piceae, sp. n., is described from Massachusetts, where it was found on *Picea pungens*, and New Hampshire.

GENTNER (L. G.) & NORRIS (R. K.). **Dormant Sprays and their Use for the Control of Insect Pests of Fruit Trees in the Rogue River Valley.**—*Sta. Bull. Oregon agric. Exp. Sta.* no. 321, 55 pp., 18 figs. Corvallis, Ore., December 1933. [Recd. May 1934.]

Tests of dormant sprays during 1924–32 on pear and one variety of apple (Yellow Newtown) in Oregon showed that lubricating (petroleum) oils with a viscosity of 100–120 secs. Saybolt and a sulphonatable fraction of 50–70 per cent. are satisfactory. On all the varieties of pear tested except one (Winter Nelis), 4 per cent. sprays of these oils may be applied with reasonable safety from the beginning of the dormant period until the cluster buds are separating ; after the early pink stage, there is some risk of scorching. Dormant oil sprays should not be applied to pear in autumn, as they may injure the fruit-buds of all varieties. On Winter Nelis, a lime-sulphur spray is preferable ; a 2 per cent. oil spray causes no injury, but is useless against severe infestations of pests. The emulsions used were of the quick-breaking type and generally contained either a calcium caseinate or casein-ammonia emulsifier. Some commercial emulsions of the mayonnaise type were also used. There was never any reduction in crop yield (except of Winter Nelis) due to oil sprays. Sprays containing 12 per cent. liquid lime-sulphur caused no injury to any variety. The same materials were also successful on apple and caused no damage, provided that the oil sprays were applied in spring up to the time when the buds showed the green leaf tips and the lime-sulphur early in the season.

Aspidiotus perniciosus, Comst., on apple and pear was effectively controlled by these sprays, and in fine weather by dry lime-sulphur (30 lb. to 100 U.S. gals.), though in most seasons this was less effective than the liquid lime-sulphur. Female scales thoroughly covered with lime-sulphur are rendered sterile. The trees should be thoroughly wetted with spray, and loose bark should be scraped off before spraying.

Infested seedlings near orchards should be treated or destroyed. These sprays were also effective against *Eriophyes pyri*, Pgst. (pear leaf blister mite) on apple and pear if applied before the leaves were showing, and both liquid and dry lime-sulphur prevented serious injury by the mite when applied on pear up to the time the leaf buds were ½ inch long. Lime-sulphur may be applied over a longer period than oil, and against severe infestations it is safer. The rust mite [*Phyllocoptes schlechtendali*, Nal.] has caused little injury to pear when these sprays have been applied; during the growing season it may be kept in check by a spray containing 1 per cent. summer oil.

[**Codling Moth and other Orchard Pests.**]—*Trans. Ill. St. hort. Soc. 1933* **67** 516 pp., 6 figs. Springfield, Ill., 1934.

This volume includes a number of papers dealing with measures employed against orchard pests in Illinois during 1933. M. D. Farrar, in a paper entitled The present Status of Oil Sprays (pp. 168–174), shows that dormant oil emulsions have been successfully used for a number of years against various pests in different parts of the United States without apparent injury to fruit trees. Sprays of 2 per cent. summer oil with the addition of 10 per cent. oleic acid or 1 per cent. summer oil with nicotine sulphate (1 : 800) have proved satisfactory substitutes for arsenicals against the second and third broods of the codling moth [*Cydia pomonella*, L.]. The most efficient spray contained 4 lb. lead arsenate, 8 lb. hydrated lime and 0·5–0·75 per cent. actual oil in 100 U.S. gals. Apples sprayed with this mixture will require washing with modern machinery and efficient washing solutions.

W. P. Flint, reporting on Codling Moth Experiments during 1932–1933 (pp. 175–183), compares data obtained in southern and western Illinois with those from Indiana, Ohio and Michigan, including tests with numerous substitutes for lead arsenate. Apples were gathered from trees 24 hours after spraying (with 7 different materials) and daily for 3 weeks in such a way that the surface was not touched [*cf. R.A.E.*, A **20** 290]. The ends were then sealed with paraffin wax, and 10 newly hatched larvae of *C. pomonella* were placed on each. Infestation of those gathered in the first and second weeks averaged 42 and 55 per cent. respectively. In the second week, the infestation of apples sprayed with 4 lb. lead arsenate and 8 lb. lime (per 100 U.S. gals.) was 68 per cent., as compared with 74 per cent. of untreated apples. These results indicate that lead arsenate and oil is still the best combination [**22** 282]. In some comparative tests of second-brood sprays, 4 lb. natural cryolite with 1 per cent. oil proved nearly as good, but the residue was almost as hard to remove. In years when *C. pomonella* is excessively abundant, oil-nicotine sprays must be applied at intervals of 7–10 days when second-brood hatching is at its maximum. Of the 10 most lightly and 10 most heavily infested orchards in southern Illinois, the average ages were respectively 16 and 27 years. The former were sprayed 9 times during the season at the rate of over 1 U.S. gal. for each year of the tree's age, and the latter 7 times (with very similar materials) at about two-thirds the rate.

B. A. Porter, discussing Codling Moth Control (pp. 184–192), outlines a programme in which special emphasis is placed on supplementary measures, such as scraping and banding, packing-shed sanitation, and destruction of infested fruit. The spraying schedule involves the use of lead arsenate up to the date after which residues can no longer be

reduced below the tolerances [**22** 183] by washing. This date varies for different districts. Except for extremely limited areas, it is impossible to recommend a practical programme that does not involve washing. Various combinations that may be substituted for lead arsenate in the later sprays are discussed.

W. A. Ruth, on the basis of work in Illinois in 1933, reviews Important Factors involved in Spray Residue Removal (pp. 257–268). A study of the effect of washing upon the keeping quality of the fruit in storage will be completed before final recommendations can be offered. This paper is followed by Washing Recommendations for Illinois (pp. 269–275) by K. J. Kadow, Problems in Heating the Wash Water in Apple Washing Machines (pp. 276–292) by A. H. Reed, and Residue Removal Experiences in 1933 (pp. 292–302) by D. F. Fisher, who deals with work in various States, particularly in the Pacific Northwest.

L. H. Shropshire, recording Observations on Orchard Insects in Northern Illinois (pp. 366–368), states that 13 per cent. of apples grown there in 1933 were rendered unmarketable by insects. Although a smaller crop was produced than in 1932, the percentage of fruit infested by *C. pomonella* in sprayed orchards in 1933 averaged only 5·48, as compared with 7·42. On the other hand, injury from curculio [? *Conotrachelus nenuphar*, Hbst.] to apples in northern Illinois, which amounted in 1932 to less than 1 per cent., increased to over 3 per cent. in 1933. The weevils can best be controlled by orchard sanitation and lead arsenate sprays applied at petal-fall and a week later, in addition to the other regular sprays against *C. pomonella*. Curculio injury is less likely to occur in cultivated orchards than in those covered with sod. Oyster-shell scale [*Lepidosaphes ulmi*, L.] has caused trouble in some apple orchards. Sprays of 1 per cent. summer oil will kill the newly hatched scales, and the usual applications of lime-sulphur are of some value. Hatching usually occurs in the first half of June in northern Illinois. The oil-nicotine sprays used against the second brood of *C. pomonella* should be of value in controlling leafhoppers, which were generally abundant during the latter part of the season, causing considerable injury to foliage.

W. P. Flint and S. C. Chandler, in The Most Effective Spray for Codling Moth Control (pp. 491–505), recommend a schedule for use in Illinois. In an orchard more than 18 years old, all trees must be scraped, all litter in the orchard picked up and burnt, and the ground raked. Of the hibernating larvae of *C. pomonella* in several orchards, 80 per cent. were in bands on the trees, 13 per cent. on the trees and 7 per cent. on the ground. Neither dormant oil sprays nor lime-sulphur have any effect on them. The calyx spray is 2 lb. lead arsenate in 100 U.S. gals. lime-sulphur. A cover spray of 4 lb. lead arsenate in lime-sulphur should be applied as soon as bait-jars and emergence cages indicate the hatching of the first eggs of *C. pomonella*, about 7–10 days after the first adults are seen and about 3 weeks after the calyx spray. During the past 4–5 years, it has been necessary to apply another first-brood cover spray about 5 weeks after petal-fall, containing 4 lb. lead arsenate and 8 lb. lime and (if the orchard is badly infested) ¾ U.S. gal. summer oil. As soon as the second-brood larvae start to hatch, 4 lb. lead arsenate and 1 per cent. summer oil or 0·5–0·75 per cent. dormant oil should be applied, and this should be repeated two weeks later. No further sprays will normally be needed on autumn varieties, but should the season continue dry and hot, 1–3 additional sprays will be required to control late larvae on winter

varieties. Such a schedule will involve washing to remove spray residue, and if oils are used in second-brood sprays, the best equipment will be essential. This schedule reduced infestation in a 26-year-old orchard from 30 per cent. in 1932 to 4 per cent. in 1933.

KRONE (P. R.), MCDANIEL (E. I.) & NELSON (R.). **Gladiolus Culture, Insects and Diseases.**—*Circ. Mich. agric. Exp. Sta.* no. 149, 32 pp., 8 figs., 8 refs. East Lansing, Mich., January 1934. [Recd. June 1934.]

The section on insects infesting *Gladiolus* in Michigan, by McDaniel (pp. 13–20), deals briefly with the bionomics and control of *Pseudococcus maritimus*, Ehrh., and *Anuraphis tulipae*, Boy., and rather more fully with *Taeniothrips gladioli*, Moult. & Stnw. [*cf. R.A.E.*, A **21** 478, 604, etc.]. Corms may be freed from the thrips and the mealybug by immersion for ½–3 hours in a 50 per cent. carbon bisulphide emulsion diluted 1 : 1,000 at 100°F.

HILL jr. (S. B.), YOTHERS (W. W.) & MILLER (R. L.). **Effect of Arsenical and Copper Insecticides on the natural Control of Whiteflies and Scale Insects by Fungi on Orange Trees in Florida.**—*Florida Ent.* **18** no. 1 pp. 1–4, 2 refs. Gainesville, Fla, April 1934.

A brief account is given of experiments to test the effect of lead arsenate and copper compounds, which have been found the most promising insecticides in bait-sprays against *Ceratitis capitata*, Wied. [*R.A.E.*, A **20** 130], on the fungi attacking Aleurodids (*Dialeurodes* spp.) and the purple scale [*Lepidosaphes beckii*, Newm.] on orange trees in Florida. The concentrations in 200 U.S. gals. bait-spray were 4 lb. in the case of copper acetate and 8 lb. in that of the other insecticides. The following is substantially the authors' summary: Lead arsenate, cryolite and potassium aluminium fluoride allowed Aleurodids to increase so that after 8 months the infestation was 1½–5 times as great as on untreated trees, whereas copper compounds allowed them to increase to an infestation 5–10 times as great as that on the latter. Unsprayed groves may have a natural fungus control of Aleurodids as high as 90 per cent., but when groves are treated with any spray containing a copper compound, such as Bordeaux mixture, only about 40–50 per cent. control can be expected.

Copper compounds allowed *L. beckii* to increase to a population nearly twice as great as that on untreated trees. Lead arsenate, cryolite and potassium aluminium fluoride had no measurable effect on the amount of scale fungus or on the live scale population. Bordeaux mixture (4 : 4 : 50) allowed the greatest increase of scale, followed closely by copper carbonate. The natural control of 60 per cent. that may be expected in unsprayed groves is reduced to 20 per cent. in groves sprayed with Bordeaux mixture.

THOMPSON (W. L.). **Non-arsenical Stomach Poisons for Grasshopper Control.**—*Florida Ent.* **18** no. 1 pp. 5–10. Gainesville, Fla, April 1934.

An account is given of tests recently carried out with non-arsenical stomach poisons for the control of grasshoppers attacking *Citrus* in

Florida, where the most injurious species is *Schistocerca americana*, Drury, in view of recent legislation prohibiting the use of arsenicals in *Citrus* groves except under special permit. Baits proved more effective than dusts or sprays. The best results were obtained with sodium fluoride used at the rate of 1 lb. to 20 lb. bran with 2 U.S. quarts syrup, and with a material made up of 96 per cent. sodium fluosilicate used in bran mash at the rate of 3 lb. to 50 lb. bran, with 1 U.S. gal. syrup and about 10 grape fruit, which gave 100 per cent. kill in 3–4 and 2–3 days respectively. No scorching of foliage was observed in either case when the bait was thrown on the plants. A bait containing double the amount of sodium fluoride was less effective. Copper carbonate gave only fair results unless used in rather large amounts.

Crumb (S. E.) & Chamberlin (F. S.). **The Effect of cool Temperatures on some Stages of the Cigarette Beetle.**—*Florida Ent.* **18** no. 1 pp. 11–14, 3 refs. Gainesville, Fla, April 1934.

In view of the use of cool chambers with temperatures ranging from 50 to 65°F. for the storage of cigars, tests have been carried out to determine the effect of such temperatures on *Lasioderma serricorne*, F. The results indicate that the eggs do not hatch at 50–60°F., and are non-viable upon removal to a normal temperature after an exposure of 35 days ; and a limited number of tests indicate that newly hatched larvae do not survive an exposure of 21 days. Large larvae survive for at least 45 days and sometimes puncture cigars at this temperature. At 56°F., eggs do not hatch and are non-viable after an exposure of 33 days. At 65°F., development of all stages continues at a reduced rate ; but very few of the newly hatched larvae survive after the eggs and resulting larvae have been exposed for 32 days. As stages other than the eggs and very small larvae occur very rarely in fresh cigars, it seems that storage of such cigars at 55°F. for 35 days should provide satisfactory control.

Sawyer, jr. (W. H.). **The Development of** *Entomophthora sphaerosperma* **upon** *Rhopobota vacciniana*.—*Ann. Bot.* **47** no. 188 pp. 799–809, 2 pls., 1 fig., 6 refs. London, October 1933.

In 1923 in Massachusetts the author found *Entomophthora sphaerosperma* infesting larvae of *Rhopobota naevana*, Hb. (*vacciniana*, Pack.), an important pest of the cultivated cranberry (*Vaccinium macrocarpon*). Pieces of potato on which a pure culture of the fungus was growing were used as stoppers for vessels in which healthy larvae were confined. These became infected either by coming in direct contact with the fungus or by the conidia falling upon them. Half an hour's exposure yielded 100 per cent. infection. Conidia germinated in 1½ hours and the germ tube penetrated the body wall of the larva in 2–12 hours. Infection never occurred through the digestive tract. The development of the fungus in the insect is described ; the average time necessary for it to complete its cycle was 72 hours. The larva showed evidence of infection only after the disease had become well established, the first symptoms being a change from a green to a yellowish colour and restless movements, followed by sluggishness and increased turgidity. Death occurred near the end of the vegetative development of the fungus.

LEFEBVRE (C. L.). **Penetration and Development of the Fungus, *Beauveria bassiana*, in the Tissues of the Corn Borer.**—*Ann. Bot.* **48** no. 190 pp. 441–452, 1 pl., 2 figs., 11 refs. London, April 1934.

An account is given of further investigations on the development of *Beauveria bassiana* infesting larvae of the European corn borer [*Pyrausta nubilalis*, Hb.] in the laboratory in Massachusetts [*cf. R.A.E.*, A **19** 266]. Larvae were infected by allowing them to crawl over a culture of the fungus and also by injecting a spore suspension. The germinating spores on the surface of the larvae produced infection hyphae, which at any point except the head were observed to penetrate the epidermal layer. They also penetrated the thinner parts of the chitinous covering of pupae. In the case of larvae imported from Manchuria, there were definite indications that infection might also take place by way of the alimentary tract. The larvae from Manchuria were probably already infected before being imported and so succumbed quickly when submitted to environmental conditions favourable to the development of the fungus. They would, therefore, apparently not be a favourable source of material for establishing insect parasites in the United States.

GNADINGER (C. B.). **Pyrethrum Flowers.**—Demy 8vo, xi + 269 pp., frontis., text ill., 604 refs. Minneapolis, Minn., McLaughlin Gormley King Co., 1933. Price not stated. [Recd. July 1934.]

The information contained in this book on pyrethrum is taken from an extensive literature and from personal investigations of the author. The botanical characteristics of *Chrysanthemum cinerariaefolium* (the only species of importance as a source of the product) are described, and its cultivation on a commercial scale, particularly in Jugoslavia and Japan, is discussed. In addition to chapters on the active principles of pyrethrum, its evaluation by chemical and biological methods and all aspects of its preparation and use as an insecticide, others contain information on factors affecting the quality of the flowers during storage, on methods of adulteration and their detection, and on the possibilities of pyrethrum as a commercial crop in the United States.

GILLIATT (F. C.). **Notes on the Lesser Budmoth, *Recurvaria nanella* Hbn.**—*Sci. Agric.* **14** no. 9 pp. 466–476, 10 figs. Ottawa, May 1934. (With a Summary in French.)

Recurvaria nanella, Hb. (lesser bud moth), all stages of which are described, is a minor pest of apple trees in the Annapolis Valley (Nova Scotia). Its biology is very similar to that of *Eucosma* (*Spilonota*) *ocellana*, Schiff. [*cf. R.A.E.*, A **20** 228]. The larvae of the two moths are easily confused, particularly during the first few weeks of spring, and characters by which they may be distinguished with a hand lens are given. The larvae of *Recurvaria* hatch in August and mine within the leaves for a time before migrating to the smaller, outer limbs, where they pass the winter under old bud scales or loose bark in hibernacula of tightly woven silk covered on the outside with

frass. Most of them entered hibernation between 15th and 25th September in 1929. In late April or early May, they emerge and make their way into the developing buds at the tips or, if these have not expanded sufficiently, through or between the bud scales; after the buds open, they web together the leaves and blossoms. They complete their feeding in about 8 weeks (after which the trees soon overcome the injury) and then spin cocoons under loose bark on the trunk or branches or more rarely among the partly eaten leaves, in which they pupate after 8–22 days. The pupal stage lasts about 3 weeks. In 1929, emergence of the adults started about the beginning of July and continued for about 3 weeks. Their restricted flight may account for the patchy occurrence of infestation in the field. The few records obtained indicate that the females are capable of laying 75–100 eggs or more. In the field, they were deposited on the lower surface of the leaves and on the petioles. In captivity, oviposition occurred from about mid-July to mid-August and the incubation period occupied 23 days.

DE GRYSE (J. J.). **Quantitative Methods in the Study of Forest Insects.** —*Sci. Agric.* **14** no. 9 pp. 477–495, 13 refs. Ottawa, May 1934. (With a Summary in French.)

A review is given of the investigations of other workers on insect populations in forests, which may be divided into general studies of animal communities and special studies of individual species or groups of species, with particular reference to those conducted in Europe [*R.A.E.*, A **9** 599; **13** 608; **14** 208; **17** 145, 146]. With one exception [**17** 146], the special studies have dealt with borers; additional difficulties arise when a defoliating insect is concerned. Two methods are described by which the progress of the reduction of an infestation of maple by the larvae of *Paraclemensia acerifoliella*, Fitch (maple leaf-cutter) [*cf.* **10** 531] near Ottawa was followed during 1928–30 by examination of the leaves of twigs removed from sample plots and trees. These methods proved satisfactory in determining the rate of decrease in numbers from stage to stage and from year to year, and also in the analysis of other biological phenomena. With the necessary modifications, they could probably be adapted to investigations of leaf-miners and insects that feed gregariously.

[NEVSKIĬ (V. P.).] **Невский (В. П.). The Mulberry Geometrid (*Apocheima cinerarius* Ersch.) and its Control.** [*In Russian.*]— Demy 8vo, 80 pp., 20 figs., 2 refs. Moscow, SAOGIZ [Amalgam. St. Pub. centr. Asiat. Sect.], 1933. Price 1 *rub.* 50 *kop.* [Recd. June 1934.]

A detailed account is given of observations on the bionomics of *Apocheima* (*Biston*) *cinerarius*, Ersch., carried out in 1926–32 in eastern Uzbekistan, where it is a serious pest of fruit trees and especially mulberry. It is confined to Central Asia, where its natural food-plants are poplar, elm and willow. The introduced apricot and white mulberry (*Morus alba*) are now, however, decidedly the preferred ones, though black mulberry (*M. nigra*) is not readily attacked. The larvae feed chiefly on the leaves and bursting buds, but sometimes

also attack the flowers, and on apricot and cherry the young fruits. All stages are described, and characters are given distinguishing the larvae and adults from those of *Pterotocera declinata*, Stgr., which attacks apricot but not mulberry, together with a key to the pupae of these two Geometrids and of the Noctuids, *Monima incerta*, Hufn., and *Cosmia subtilis*, Stgr. (apricot Noctuid), which often occur together in the soil.

Though *A. cinerarius* is common in many parts of Central Asia, it is a serious pest of mulberry only in the Khodjent region of eastern Uzbekistan. This is probably due to the mildness of the spring, the absence of heavy rains, which elsewhere wash the larvae from the trees, and the occurrence of a favourable combination of food-plants. The introduction of mulberry alone would not have favoured mass outbreaks, since many of the larvae on it hatch before the buds are sufficiently developed to provide them with food, so that their numbers are constantly reduced by starvation. On apricot, however, the flower-buds begin to open before the appearance of the larvae. Serious injury to mulberry is apparently unusual in districts where apricots are not cultivated. Nevertheless, strains of the moth occur that develop for successive generations on mulberry, apricot and poplar; they are characterised by differences in larval coloration and markings, which have been found to be hereditary.

There is one generation in a year, of which about 9 months are spent in the pupal stage in the soil. The moths are emerging for 4–6 weeks, beginning in February or sometimes January, as soon as the soil temperature rises to 3–4°C. [37·4–39·2°F.], and crawl up the trunks of the trees, hiding by day in cracks of the bark. The males take wing at night and are readily attracted by light, but the females are wingless. Oviposition begins soon after emergence and continues till about the end of March, the eggs being laid in cracks, under loose bark, etc. In the insectary, the number laid by a female varied from 160 to 758. The larvae hatch in from 10 to 35 days, according to the temperature, and become abundant in April when all instars are found simultaneously. The newly hatched larvae can resist starvation for 4–8 days. The larval stage lasts 30–40 days. The larvae are fairly active, and if the tree is shaken, they drop on fine threads. They often migrate from tree to tree by means of these threads or by crawling on the ground. Pupation begins about 20th April, the pupae occurring at a depth of 4–8 ins. in the soil close to the trunks of the trees.

The larvae are sometimes parasitised by a Scelionid that usually attacks *Monima incerta*, and more frequently by the Tachinid, *Gonia* (*Salmacia*) *cilipeda*, Rond., which also infests *Pterotocera declinata*. The eggs of this fly are laid on the leaves and swallowed by the larvae of the Geometrids; the maggot pupates in the soil, abandoning the host just before or after the latter pupates.

Measures for control are discussed in detail. They include the application of adhesive bands against the females crawling up the trunks of the trees, which is the most effective; hoeing of the soil to destroy the pupae, and shaking the larvae off the trees, both of which are only of supplementary value; and spraying poplars, elms or apricots growing near the mulberry trees with calcium arsenate ($2\frac{1}{2}$ lb. with $2\frac{1}{2}$ lb. lime in 100 gals. water), or with sodium fluoride or fluosilicate (7 lb. in 100 gals.). These insecticides cannot be applied to the mulberries, as the leaves are used for feeding silkworms [*Bombyx mori*, L.]. In

laboratory tests of various sprays, however, it was found that pyrethrum-soap is highly toxic to the larvae of the Geometrid and has no effect on silkworms fed on leaves sprayed 10 days previously.

THOMPSON (H. W.). **The Cockchafer Beetle, its Incidence and Control.** —*Welsh J. Agric.* **10** pp. 308–316, 1 pl., 1 ref. Cardiff, January 1934. [Recd. June 1934.]

The larvae of *Melolontha melolontha* L. (*vulgaris*, F.), which is usually fairly abundant in South Wales but is seldom very injurious, caused severe damage to strawberries, young fruit trees, vegetables, grass, cereals and root crops and, together with *Phyllopertha horticola*, L., also to seedlings of spruce and larch, in Monmouthshire during the summers of 1932 and 1933. Typical instances of the losses sustained on farms and market gardens are given ; in some cases they were estimated at over £100 per acre. In 1933, the outbreak was checked, apparently by the abnormally dry conditions during the summer, which forced the larvae deeper down into the soil, where they starved. The history of previous severe attacks is given. The eggs are laid early in the summer, several inches below the surface of the soil. The larvae, which hatch in 5–6 weeks, cause little injury during the first year but feed for the three succeeding ones on roots. The pupal period is passed lower in the soil and occupies several weeks, the adults emerging about October but remaining below ground until the following May. The beetles are particularly numerous every fourth year, when they frequently cause considerable injury to the foliage of trees and bushes. Most of the larvae had descended deeper into the soil for hibernation by 28th October 1932 and had ascended again by 20th April 1933.

Tests, which are described, indicated that naphthalene at the rate of 5–6 cwt. per acre will give satisfactory control of the larvae when it can be worked into the ground or is washed in by rain [*cf. R.A.E.*, A **15** 578]. Where land is ploughed between April and September, the most effective and economical method is the hand-collection of the larvae, but where ploughing is not possible until late in the autumn, an application of naphthalene might be of value in September before hibernation begins. Satisfactory results were obtained with 3 cwt. naphthalene on grassland in one case, but in another test it failed owing to the dry conditions. A dressing of 25 cwt. soot before ploughing appeared to be effective. Many grubs were collected by birds.

CHAPPELLIER (A.) & RAUCOURT (M.). **La toxicité envers le gibier des insecticides arsenicaux.**—*C. R. Acad. Agric.* **20** no. 18 pp. 598–603, 1 ref. Paris, 1934.

The authors undertook experiments in which they determined the minimum lethal doses for hares, rabbits and partridges of four insoluble arsenicals commonly employed as insecticides. The results showed that diplumbic lead arsenate (20·2 per cent. As) is the least dangerous to animals, and Paris green (42·2 per cent. As) the most dangerous, being at least six times as toxic. Tricalcium arsenate (27·7 per cent. As) and aluminium arsenate have an intermediate toxicity. The repeated absorption of sublethal doses does not appear to result in cumulative poisoning.

DRAGOUN (J.). **Biologie der Schlupfwespe *Aphidius fabarum* Marsh., eines Parasiten der Blattlaus *Aphis fabae* Scop.** [The Biology of *A. fabarum*, a Hymenopterous Parasite of the Leaf Aphid, *A. fabae*.]—*Ber. ForschInst. čsl. Zuckerindustr.* **37** (1933–34) pp. 163–166, 2 figs. Prague, 1934. (Repr. from *Z. Zuckerindustr. čsl. Repub.* 1933–34 pp. 113–116.)

The Braconid, *Aphidius fabarum*, Mrsh., is an important parasite of *Aphis fabae*, Scop., in Czechoslovakia. In the laboratory at 23°C. [73·4°F.], the adults paired within 30 minutes of emergence and the females soon began ovipositing in the Aphids. Only one larva was observed in each host, although the female parasites were sometimes seen attacking the same individual repeatedly. Young Aphids were preferred. The changes that occurred in parasitised Aphids are described; they not only lived for a shorter period, but also failed to reproduce. The average time required for development of the parasite from egg to adult was 10 days, 5 being spent as a pupa within the host. Adults lived 10 days in the laboratory.

NEUWIRTH (F.). **Die ersten vergleichenden Versuche mit Arsenpräparaten und Bariumchlorid als Bekämpfungsmittel gegen den Rübenrüsselkäfer in der Čechoslovakei.** [The first comparative Experiments with Arsenicals and Barium Chloride against the Beet Weevil in Czechoslovakia.]—*Ber. ForschInst. čsl. Zuckerindustr.* **37** (1933–34) pp. 199–205, 2 figs. Prague, 1934. (Repr. from *Z. Zuckerindustr. čsl. Repub.* 1933–34 pp. 169–175.)

An account is given of tests against the sugar-beet weevil [*Conorrhynchus mendicus*, Gyll.] in Czechoslovakia in which two proprietary dusts containing calcium arsenate were compared with a spray of barium chloride at a concentration of 3½ per cent. The dusts proved much more effective and more rapid in action, and showed superior resistance to the effect of rain. Moreover they caused no injury, even to seedlings, whereas the young beet plants were often severely scorched by the spray.

NEUWIRTH (F.). **Schädlinge und Krankheiten der Rübe im Jahre 1933.** [Pests and Diseases of the Sugar-beet in 1933.]—*Ber. ForschInst. čsl. Zuckerindustr.* **37** (1933–34) pp. 287–290. Prague, 1934. (Repr. from *Z. Zuckerindustr. čsl. Repub.* 1933–34 pp. 273–276.)

The insect pests of beet here mentioned have all been recorded from Czechoslovakia in previous reports [*R.A.E.*, A **20** 258, 479, 576; **21** 442]. Considerable injury, particularly to seedlings, was caused by *Aphis fabae*, Scop., and it was not until the end of July that *Aphidius* [*fabarum*, Marsh.] and Coccinellid beetles brought the outbreak to an end.

HARMSEN (E. E.). **Onderzoek naar de oorzaak van ziekteverschijnselen bij aardbeien.** [An Investigation of the Cause of diseased Conditions in Strawberry Plants.]—*Tijdschr. PlZiekt.* **40** no. 6 pp. 137–152, 4 pls., 7 refs. Wageningen, June 1934.

An investigation in 1931 of the cause of a disease-like condition of cultivated strawberries in Holland showed them to be infested by

the mites, *Tarsonemus fragariae*, Zimm., and *Tetranychus fragariae*, Oudms., and the Aphids, *Capitophorus potentillae*, Wlk. (*Pentatrichopus fragaefolii*, Ckll.) and *Macrosiphum* sp. Experiments on the symptoms produced on wild strawberry plants by the first three species showed the condition of the cultivated ones to be due to *Tarsonemus fragariae*.

Biological observations on the two mites indicated that they hibernate as mature females. Eggs, larvae, nymphs and adults could be found throughout the spring and summer, but the males were much less numerous than the females, and in the case of each species pairing was only observed once. *Tarsonemus fragariae* avoids light and is therefore not found by day on open leaves.

In the laboratory, alatae of *Capitophorus potentillae* always produced apterae, but individual apterae sometimes produced apterous and alate parthenogenetic Aphids and apterous sexual females. This occurred in three successive generations of a single strain. Males were never observed, however, and eggs laid by the sexual females were infertile. Only two sexual females were found on strawberry in the field, on 31st December. The temperature at 9 p.m. on this date was −10°C. [14°F.] ; it had been below freezing point for several days. On 16th February, a larva was found, the temperature during the 10 preceding days having fluctuated between −5 and +5°C. [23–41°F.]. In the greenhouse, apterous and alate Aphids occurred, but no sexuales.

Spoon (W.). **Het insecticide rotenon in de nederlandsche praktijk, eerste proefjaar.** [The first Year's Tests with Rotenone in Practical Work in Holland.]—*Ber. Afd. Handelsmus. k. Ver. kolon. Inst.* no. 83, 17 pp., 2 figs., 22 refs. Amsterdam, 1933. (Repr. from *De Indische Mercuur* 20th Dec. 1933.)

In continued investigations on rotenone [*cf. R.A.E.*, A **21** 617, 618], tests were made with sprays in Holland in 1932, using a derris powder containing 2 per cent. rotenone and a pure rotenone powder. The powders must be kept in a dark, dry place and the sprays prepared only when required. The formulae were 2 oz. derris powder and 1 oz. soft soap in 100 fl. oz. water (1 part rotenone in 2,500), and a solution of 1 oz. pure rotenone powder in 25 fl. oz. acetone diluted 200 times with water (1 part rotenone in 5,000).

Against Tetranychid mites, the derris spray was effective on cucumbers and beans, but not on grapes (except in one case) or on peaches. Both sprays gave good results in some cases against leaf Aphids. The one containing derris was ineffective against *Anthonomus rubi*, Hbst., and *Rhynchites aeneovirens* ab. *minutus*, Hbst., on strawberries. Excellent results were obtained with the spray of pure rotenone against *Byturus* [*tomentosus*, F.] on raspberries [*cf.* **20** 331 ; **21** 295, etc.].

Kemper (H.). **Ueber Hausmottenbekämpfung.** [Measures against Moths in Houses.]—*Z. GesundhTech. Städtehyg.* **26** no. 6 pp. 317–330, 2 figs. Berlin, June 1934.

This is a useful survey of the bionomics of *Tineola biselliella*, Humm., *Tinea pellionella*, L., and *Trichophaga tapetzella*, L., and of the methods of preventing and controlling infestation by them. The adults of the three species are briefly described.

Roncoroni (E.). **Piante ed insetti ed alcuni nemici della battaglia del grano.** [Plants and Insects and some Enemies of the Grain Campaign.]—Med. 8vo, 274 pp., 41 pls. Varese, Consorzio obblig. prov. Lotta contro il Maggiolino, 1934.

This volume belongs to the same series as one already noticed [*R.A.E.*, A **22** 159]. Nearly half of it is devoted to insects, which are dealt with under three sections. The first and second (pp. 147–235 and 236–267) comprise notes on the bionomics and control of the principal pests of cereals and of Aphids infesting fruit trees, vegetables, etc., in Italy, and the third deals briefly with Coccids in general.

Silvestri (F.). **Rassegna degli insetti dell'olivo del bacino del Mediterraneo.** [A Review of the Insect Pests of Olive of the Mediterranean Basin.]—*XI Congr. int. Olivicolt. Lisbona*, reprint 42 pp. Rome, 1934.

Nearly half of this comprehensive survey of the insect pests of olives in the Mediterranean basin is devoted to *Dacus oleae*, Gmel., the remainder comprising brief notes on over 70 species. The work done in Italy with baits and bait-sprays against *D. oleae* is discussed, a suggested spray formula being beet molasses 95 gals., sodium arsenite 30 lb., and water 2 gals. Just before application, 1 gal. of this mixture is diluted with 9 gals. water with the addition of 1 lb. of sulphate or nitrate of ammonia or of any other substance known similarly to increase and, especially, conserve the attractiveness of the spray. Even for a large tree, the amount applied need seldom exceed 35 fl. oz.

In appendices, Dr. G. Russo (pp. 31–39) deals with the three Scolytids that attack olives in southern Italy [*R.A.E.*, A **20** 318], and A. Melis (pp. 40–42) records observations on *Liothrips oleae*, Costa, in Tuscany. The hibernated adults of this thrips mated from mid-April onwards, ovipositing in sheltered places on the trees early in May. The larvae fed on the tender shoots. The first-generation adults appeared early in July, and second-generation larvae about the middle of the month. They attacked the small olive fruits, causing them to fall. Immature stages were scarce from mid-August to the end of September, but larvae again appeared in October and when they became adults entered hibernation in the galleries of Scolytids and other sheltered places on the trees.

Natural enemies observed were an unidentified Cecidomyiid, the Eulophid, *Tetrastichus gentilei*, Del G., which sometimes parasitised up to 75 per cent. of the larvae and completed its life-cycle in about 20 days, and an Anthocorid (? *Ectemnus reduvinus*, H.-S.), the nymphs, and to a less extent the adults, of which destroyed large numbers of the thrips, the nymphal stage lasting about 20 days.

Gösswald (K.). **Zur Biologie und Oekologie von *Parasetigena segregata* Rond. und *Sarcophaga schützei* Kram. (Dipt.) nebst Bemerkungen über die forstliche Bedeutung der beiden Arten.** [On the Biology and Ecology of *Phorocera silvestris*, R.-D., and *S. schützei*, with Observations on the Importance of the two Species in Forests.]—*Z. angew. Ent.* **21** no. 1 pp. 1–23, 6 figs., 21 refs. Berlin, June 1934.

Records of the importance of *Phorocera silvestris*, R.-D. (*Parasetigena segregata*, auct.) as a parasite of the nun moth [*Lymantria monacha*, L.]

are cited and discussed. In the course of a nun moth outbreak in Germany, the flies were emerging in cold, wet weather over a period of 4 weeks. In the laboratory they fed on sugar, and in the field on exudations from pine bark and needles. The long period of emergence of the flies renders negligible the reduction in their numbers that may be expected to follow the application of a pyrethrum dust, which loses its toxicity in a few hours.

Experiments showed that cold and moisture are favourable to the pupae of this Tachinid. Larvae exposed to 8 temperatures from 8 to 28°C. [46·4–82·4°F.] and to 6 humidities from 25 to 100 per cent. all reached the pupal stage, but it was only at 100 per cent. humidity, or sometimes at 90, that the pupae remained alive. At temperatures from 15 to 28°C. [59–82·4°F.], pupation was rapid, so that the danger of the full-grown larva being exposed to low humidity (to which it is very susceptible) is reduced. Pupae were already light brown in 13 days at 15°C. [59°F.]. The duration of the pre-oviposition period of the flies varied according to temperature and food. Its prolongation is not wholly a disadvantage if days warm enough for oviposition occur at the end of it, as the eggs are then laid in older larvae and the parasites complete their development, whereas in young larvae they are liable to die prematurely with their hosts.

Sarcophaga schützei, Kram., was originally described as having been bred from *L. monacha* and *Dendrolimus pini*, L., but no subsequent record of parasitism exists despite the abundance of this fly. In laboratory experiments, it parasitised dead larvae of *Malacosoma neustria*, L., and larvae of *L. monacha* and *Porthetria dispar*, L., that were suffering from polyhedral disease, but did not attack healthy larvae. The flies deposited larvae about 4 weeks after they emerged. The larvae developed in about 4 days, and pupation was slower than in *P. silvestris*. The larvae and pupae were very resistant to dryness. This Sarcophagid is of some economic importance, as the reduction in numbers of Tachinids by predators is decreased by at least 50 per cent. if it is abundant.

JANCKE (O.). **Der Pflaumenbohrer** *Euvolvulus* (*Rhynchites*) *cupreus* **(L.).** [The Plum Borer, *R. cupreus*, L.]—*Z. angew. Ent.* **21** no. 1 pp. 24–64, 23 figs., 14 refs. Berlin, June 1934.

The following is largely taken from the author's summary of observations at Naumburg on *Rhynchites* (*Euvolvulus*) *cupreus*, L., attacking plum and cherry, the only food-plants on which he has found it in Germany: All stages of this weevil are described. The hibernated adults appear in April and in the course of maturation feeding destroy buds, young shoots and fruits. The female bites partly through a fruit-stalk, deposits an egg in a hole made in the fruit, and then covers the hole with a piece of the fruit-skin. Up to 4 eggs have been found in one fruit. Oviposition occurs over 7 weeks, up to the end of July, and the average number of eggs per female is 90. The egg stage lasts 4–11 days and the larval 20–28, the infested fruits falling to the ground. If the pulp shrivels, the larva bores into the stone and continues its development there. The pupal stage occurs at a depth of about an inch below the surface of the soil and lasts about 6½ weeks at a soil temperature of 15°C. [59°F.]. The young adults appear about 5 days later and feed on the leaves of their food-plants before hibernating. On individual branches, up to 44 per cent. of the fruits may be infested.

In small orchards, fruits with bitten stems should be collected. In large ones, the weevils should be jarred from the trees on to screens covered with an adhesive or into funnel-shaped traps. In laboratory experiments, insecticides did not prove very effective, but they might be of value if applied during the period of maturation feeding.

Some observations were made on the biology of *R. auratus*, Scop., which is a serious fruit pest in Russia [*R.A.E.*, A **3** 534] but is comparatively rare near Naumburg The weevils were caged on a plum tree. A female laid 31 eggs in the course of one month, with 5 as the highest daily number. The weevil bores a hole 2–3 mm. deep in the fruit, deposits an egg, and then excavates a channel round the hole and covers the egg with the excavated material. As a rule, only one egg is laid in a fruit and the latter remains hanging on the tree. In the laboratory at 18°C. [64·4°F.], the eggs hatch in 4–6 days.

ECKSTEIN (F.). **Das Verhältnis von *Pyrausta nubilalis* zu ihrer Wirtspflanze.** [The Relation of *P. nubilalis* to its Food-plant.]—*Z. angew. Ent.* **21** no. 1 pp. 65–88, 5 figs., 10 refs. Berlin, June 1934.

An account is given of investigations on *Pyrausta nubilalis*, Hb., in Baden, some of which have already been noticed [*R.A.E.*, A **22** 430]. In 1930, fewer eggs were found on maize plants sown on 17th May than on those sown on 24th April. Plants wide apart (24 by 24 inches) and those treated with a small quantity of nitrogenous manure harboured fewer eggs than those closer together (24 by 12 inches) or treated with more manure. Early sowing, close planting and abundant manure produced a flourishing growth at the flight-period of the moth, which began on 20th June. In autumn, the larvae were more numerous in the cobs of the early-sown plants. The distance between the plants had no effect on the number of larvae in 1930, but in 1931 plants wide apart had more larvae, a discrepancy possibly due to different weather conditions.

The exact effect of climate on the development of the plant and that of *P. nubilalis* cannot be determined without prolonged observations, but in 1930, when injury to the undeveloped cobs was more severe, the temperature and amount of sunshine were lower and the rainfall higher during April-June than in 1931. The degree of infestation in isolated fields of maize was largely governed by the distance from the chief centre of infestation and its position in relation to the prevalent winds, but crop rotation was also concerned.

LAKON (G.). **Entomophthoraceen-Studien I-IV.**—*Z. angew. Ent.* **21** no. 1 pp. 89–95, 14 refs. Berlin, June 1934.

Entomophthora pseudococci, which was originally described from *Pseudococcus boninsis*, Kuw. (*calceolariae*, auct.) on sugar-cane in Hawaii, is stated to be synonymous with *Lamia* (*Empusa*) *apiculata*, which was described from the United States. The author confirms his treatment of the genera concerned [*R.A.E.*, A **8** 273]. *Entomophthora blunckii*, sp. n., from *Plutella maculipennis*, Curt., and *Tarichium hylemyiae*, sp. n., from *Hylemyia coarctata*, Fall., are described from Germany.

Subklew (W.). *Agriotes lineatus* **L. und** *Agriotes obscurus* **L. (Ein Beitrag zu ihrer Morphologie und Biologie.)** [*A. lineatus* and *A. obscurus*. A Contribution to their Morphology and Biology.]—*Z. angew. Ent.* **21** no. 1 pp. 96–122, 17 figs., 3 pp. refs. Berlin, June 1934.

The distribution of *Agriotes lineatus*, L., and *A. obscurus*, L., is reviewed. Up to recent years *A. lineatus* was regarded as the major pest of cultivated plants in Europe, but in some countries it is of more local occurrence than *A. obscurus*. The eggs of the two species are briefly described, and a detailed account is given of the larval morphology of each. The author was unable to differentiate the pupae.

The bionomics are discussed from the literature, and original observations in Germany are recorded. *A. obscurus* was seldom seen flying, and *A. lineatus* never. The adults fed on the leaves of graminaceous plants and, when the weather was unfavourable, burrowed into the soil to a depth of 2 inches or less. Weather determines the date of their appearance in spring; they die soon after oviposition is completed. In captivity, most of the eggs were laid between 14th and 25th June, just below the surface of loose moor soil. At an air humidity of 100 per cent. and a temperature of about 18°C. [64·4°F.], they hatched in 25–30 days. Below 100 per cent. humidity, they soon perished [*R.A.E.*, A **22** 248].

Larvae of *A. obscurus* were found in light sandy soil, heavy clay soil and moor soil; those of *A. lineatus* chiefly in soil rich in humus, especially moor soil, but not in heavy soil. In the presence of sufficient moisture, young larvae lived for some weeks without food. From records in the literature the author concludes that the larvae are facultative feeders on humus that after the first year of development attack living plants and then become predominantly phytophagous and occasionally carnivorous. Their development requires about 4 years. The pupae occurred at a greater depth in dry soil than in damp soil. *A. obscurus* had a prepupal stage of 11–14 days and a pupal stage averaging 29 days at about 16°C. [60·8°F].

In the laboratory, fungi of the genera *Isaria* and *Oospora* occurred repeatedly, killing the larvae and adults. *Paracodrus apterogynus*, Hal., parasitised several larvae of *A. obscurus* kept in the field, and one larva of this Elaterid was infested by a Mermithid.

Kleine (R.). **Die Borkenkäfer (Ipidae) und ihre Standpflanzen. Eine vergleichende Studie. I. Teil.** [The Bark-beetles and their Food-plants. A comparative Study. Part I.]—*Z. angew. Ent.* **21** no. 1 pp. 123–181. Berlin, June 1934.

A list is given of all the Scolytids of which the food-plants are known, showing the plants attacked by each in various countries.

Boczkowska (M.). **Quelques observations sur l'***Isaria* **sp. parasite de** *Panolis flammea* **Schiff. en Pologne (Notice préliminaire).**—*Rev. Path. vég. Ent. agric.* **21** fasc. 1 pp. 67–74, 3 refs. Paris, 1934.

An account is given of preliminary laboratory studies, including some on its development on artificial media, of *Isaria* sp., a fungus that attacks Lepidopterous larvae and pupae in the soil, including *Panolis flammea*, Schiff., *Bupalus piniarius*, L., *Sphinx* (*Hyloicus*) *pinastri*, L., and *Dendrolimus pini*, L., hibernating under forest litter in Poland.

It was found that in dry sandy soils it tends to be more abundant at lower levels, where there is more moisture, than just below the litter, where the hibernating pupae of *P. flammea* occur. In damp, impermeable soil, however, it was present near the surface and was responsible in one case for 16 per cent. mortality of the pupae of this moth. Although the spores were not killed by low temperatures, their germination was delayed. Thus infected larvae of *D. pini* kept in an unwarmed room remained apparently unaffected under moss for 3 weeks, but when exposed to a temperature of 14°C. [57·2°F.] they quickly succumbed to the fungus.

Attempts to infect pupae of *D. pini* by various methods, such as contact with infected soil, infected dead larvae, etc., were unsuccessful owing to the unfavourable season, but the moths that emerged in the containers became mummified and covered with the fungus. This may have been due either to an infection of the moth from the pupa or to saprophytic development on it after its death. It was found possible to infect the larvae of *Galleria mellonella*, L., with completely desiccated cultures of *Isaria* that had been kept on potato for 15 months.

FRYDRYCHEWICZ (J.). **Etude sur la biologie de Bombyce du pin.** [*In Polish.*]—*Trav. C. R. Inst. Rech. Forêts Etat Varsovie* Ser. A no. 4, 36 pp., 7 refs. Warsaw, 1934. (With a Summary in French.)

An account is given of laboratory observations on *Dendrolimus pini*, L., outbreaks of which occurred on pines in several districts in northern Poland in 1930, but came to an end in May of the following year, apparently owing to a fungous disease of the larvae. Of 1,508 larvae collected at the beginning of the latter month, only 261 pupated ; most of the others died from undetermined causes, and the remainder were parasitised. In the laboratory the eggs hatched in 9 days at 30°C. [86°F.] and in 14 at 20°C. [68°F.]. Observations on the feeding habits of the larvae were carried out on the lines of previous studies by the author [*R.A.E.*, A **18** 180 ; **19** 380]. Larvae in the first two instars were all killed by three days' exposure to a temperature of 30°C. They survived starvation for average periods of 4·8 days in the first instar and 6 in the second. Larvae preferred the preceding year's pine needles to fresh ones. Pupation occurred between 16th May and 8th July, but about 50 per cent. of the larvae pupated before 23rd May, and most of the remainder between 5th and 15th June. The pupal stage lasted 13–24 days, the females emerging a few hours before the males.

[MEL'NICHENKO (A. N.).] **Мельниченко (А. Н.). The Distribution of *Loxostege sticticalis* L. in the Western Region of USSR and local Breeding Grounds of the Pest.** [*In Russian.*]—*Bull. Plant. Prot.* (1, Ent.) no. 8 pp. 5–72, 12 charts, 30 refs. Leningrad, 1934. (With a Summary in English.)

This paper deals in detail with the occurrence of *Loxostege sticticalis*, L., in the " Western Region " of European Russia (which comprises the former Smolensk Government and adjoining areas) and is based on the literature and observations in 1932. Permanent breeding foci are found in the southern steppe-forest districts, where as a rule two generations occur annually, the adults usually emerging in late May or early June and late July or early August.

The author discusses in detail and accepts the view that the moths sometimes migrate in numbers from adjoining areas or even from

south-eastern Russia [*cf. R.A.E.*, A **22** 373, etc.]; he attributes such migrations to wind. At the southern limits of the geographical distribution of *L. sticticalis* in the Russian Union, which pass through the arid semi-desert zone of Central Asia and the south of European Russia at about 45°N. lat., the rate of increase of the moth depends on fluctuations in humidity, whereas at the northern limits (55°N. lat.), which lie in the more humid steppe-forest zone, it depends on temperature. From a detailed analysis of types of vegetation and climatic conditions in the Western Region, the author concludes that the permanent foci of the moth are almost exclusively restricted to the steppe-forest districts, its northern distribution being limited by a mean July isotherm of 18·5°C. [65·3°F.]. Within these districts they chiefly occur in hilly country, as hills check the migrating moths and southern slopes are favourable for breeding. Under such conditions, fields of perennial leguminous plants, especially clover, offer the optimum conditions, since they are only ploughed at intervals of 2 or more years and the foliage and flowers provide abundant food for the larvae and adults respectively.

[Znoĭko (D. V.).] **Знойко (Д. В.). An experimental Study of the Influence of Temperature on** *Loxostege sticticalis* **L.** [*In Russian.*] —*Bull. Plant. Prot.* (1, Ent.) no. 8 pp. 79–116, 1 graph, 9 refs. Leningrad, 1934. (With a Summary in English.)

A detailed account is given of laboratory investigations carried out in Odessa in 1929 and 1930 on the effect of temperature on *Loxostege sticticalis*, L. At 15°C [59°F.], development from egg to adult was completed in 110 days. At 30°C. [86°F.], the egg and larval stages lasted 2–2·5 and 7–9 days respectively, the prepupal stage in the cocoon 2–3 days (except in the case of larvae that entered a diapause), and the pupal stage 7–9. At 24°C. [75·2°F.] the larval stage lasted a fortnight, at 19°C. [66·2°F.] three weeks, and at 15–16°C. [59–60·8°F.] over a month. The optimum temperature for the development of the eggs and larvae was between 20 and 33°C. [68–91·4°F.]. The threshold of development was about 12°C. [53·6°F.], but brief exposures to cold did not affect the vitality of the larvae, and in the laboratory batches of eggs kept at 6–10·9°C. [42·8–51·6°F.] for 3½ and 8 days hatched in 36 and 24 hours respectively. At temperatures of 37–41°C. [98·6–105·8°F.] young larvae died in 24 hours, as did older individuals at a rather higher temperature. Newly hatched larvae survived starvation for two days [*cf. R.A.E.*, A **19** 525].

The normal prepupal stage lasted 2–11 days. Excessive humidity retarded pupation and increased the rate of mortality, though about 50 per cent. of the larvae, in or removed from the cocoons, survived immersion in water for periods varying from 13 to 20 days at 3–11°C. [37·4–51·8°F.]. Some of the larvae before pupating entered a diapause that was only terminated by exposure to cold; in other cases, particularly at rather low temperatures, pupation was retarded for a few days without the occurrence of a true diapause. The percentage of larvae entering a diapause was higher when they were kept at temperatures above or below the optimum. The pupal stage lasted 7–8 days at a mean of 34·9°C. [94·8°F.] and over a month below 20°C. [68°F.].

The effect of temperature on the fertility of the moths was studied in detail [*cf.* **21** 160], and it was concluded that temperatures of 20–36°C. [68–96·8°F.] are favourable for a normal development of the ovaries and for oviposition. At 21–22°C. [69·8–71·6°F.] and still more

at 15°C. [59°F.], the development of the ovaries is retarded. At the latter temperature pairing may take place, but the eggs do not develop ; it is possible that this is due to sterility of the males. The period required for the maturation of the ovaries was 3–12 days, and for completion of oviposition 1–11.

The resistance of hibernating larvae in cocoons to a short exposure to temperatures of −15 and −20°C. [5 and −4°F.] depended on the humidity, almost all being killed if it was high and almost all surviving if it was low. Exposure for 12 hours to −30°C. [−22°F.] killed 90–95 per cent. of the larvae. They proved able to withstand sharp fluctuations of temperature, 40 per cent. surviving a sudden transfer from −30 to 24°C. [−22 to 75·2°F.]. Pupae were able to survive short exposure to −10°C. [14°F.].

[Skorkin (L. A.).] **Скоркин (Л. А.). Observations on *Loxostege sticticalis* L. in the South-western Part of the Steppes adjacent to the Black Sea in 1929–1930.** [*In Russian.*]—*Bull. Plant. Prot.* (1, Ent.) no. 8 pp. 117–135, 1 chart. Leningrad, 1934. (With a Summary in English.)

This paper is supplementary to other reports on the outbreak of *Loxostege sticticalis*, L., in European Russia in 1929 [*R.A.E.*, A **19** 521–526 ; **20** 262, 626–628] and deals with its occurrence in that year in the Odessa and Ochakov districts on the coast of the Black Sea. There were three generations, the larvae of the first causing damage to beet, soy beans, lucerne and sunflowers, and those of the third to autumn-sown cereals. In the spring, the adults appeared suddenly in great numbers and with fully developed ovaries, having evidently been carried by strong and frequent east winds. Those of the second generation were also probably brought by wind from adjoining areas, since they were abundant, though second-generation larvae, which only occurred on weeds, had not been numerous. In the north of the area these moths were sterile, but in the south very large numbers of third-generation larvae hibernated in the soil. The cocoons were most abundant in hilly localities on southern slopes, occurring at a depth not exceeding 2½ ins. In the spring of 1930, many of them were found on the surface of the soil, having been washed out by heavy rains or exposed by birds that had destroyed the larvae in them. An average of about 50 per cent. of the hibernating larvae were destroyed by predators or diseases, and a few had been attacked by parasites, which included *Labrorychus tenuicornis*, Grav., *Eulimneria rufifemur*, Thoms., *E. geniculata*, Grav., *E. xanthostoma*, Grav., *Cremastus decoratus*, Grav., and *Phytodietus segmentator*, Grav. The emergence of the adults was protracted in 1930, and their ovaries were undeveloped. Oviposition began a fortnight later than in 1929, and the larvae concentrated on weeds without attacking cultivated crops.

[Aristov (M. T.).] **Аристов (М. Т.). A Guide to the Estimation of the Incidence of Orchard Pests for the Survey Stations of the Service of Estimation. 2nd enl. Edn.** [*In Russian.*]—La. Cr. 8vo, 123 pp., 33 figs., 18 refs. Moscow, Vses. gos. Ob'ed. Bor'be Vred. Bol. sel. lesn. Khoz. (OBV). Sekt. Sluzhbui Ucheta [All-Un. St. Ass. Contr. Pests Dis. Agric. For. Sect. Serv. Estim.], 1934. Price 3 *rub.*

This handbook deals with the organisation of stations established to record the incidence of pests (chiefly insects) in the orchard districts of

the Russian Union, and with the methods to be employed for estimating the abundance of pests, the injury they cause to different parts of trees and bushes, the losses that result, and the effectiveness of spraying. Sample questionnaires are included, with notes on their use. In an appendix, descriptions are given of the types of injury caused by different pests, with a calendar showing the times, on the basis of phenological observations, at which inspections should be carried out.

SEDEL (C.). **Rapport annuel sur la situation de l'agriculture de la Province du Katanga (année 1932). Service phytopathologique.**— *Bull. agric. Congo belge* **24** no. 3 pp. 311–319, 6 figs. Brussels, September 1933. [Recd. June 1934.]

Pests recorded in Katanga (Belgian Congo) in 1932 included the Coccids, *Icerya purchasi*, Mask., and *Aonidiella* (*Chrysomphalus*) *aurantii*, Mask., on *Citrus*, the Membracid, *Oxyrhachis tarandus*, F., causing injury to mimosa, and the Trypetid, *Dacus bivittatus*, Big., infesting cucurbits.

Dense swarms of *Nomadacris septemfasciata*, Serv., and *Locusta migratoria migratorioides*, R. & F., similar to those of 1931 [*R.A.E.*, A **21** 155], again caused serious damage to maize. Eggs laid at the end of 1931 hatched during the beginning of 1932, and at the end of April numerous swarms of adults were present throughout the Province. They became widely distributed during the dry season, all flying in roughly the same direction, but when their reproductive organs matured at the beginning of the rains, their flights became irregular and females left the swarms to oviposit. Laboratory observations showed that these locusts have one generation a year, *L. m. migratorioides* appearing earlier and developing more quickly than *N. septemfasciata*. The former tended to revert to the solitary phase, but the latter remained gregarious.

In Katanga the crops are protected by the use of smoke or by waving branches in the plantations, and experience has shown that the cutting of trenches near the breeding places is very effective [**20** 71]. Sprays of sodium arsenite have proved satisfactory against the larvae ; in tests, complete mortality was obtained in 30 minutes with a 1 per cent. solution, which was found to be the minimum effective strength, but 1½ per cent. is necessary when dew is present. Sodium arsenite at these concentrations is injurious to plants and should only be applied to locusts on grass in the bush.

MACCREARY (D.). **The Efficiency of certain Proprietary Oil Emulsions, Volck and Orthol-K, for the Control of the Oriental Fruit Moth.**— *Bull. Delaware agric. Exp. Sta.* no. 184, 43 pp., 26 figs., 2 refs. Newark, Del., June 1933. [Recd. June 1934.]

The following is taken from the author's summary of a detailed account of an investigation of the efficiency of oil sprays against *Cydia* (*Grapholitha*) *molesta*, Busck, on peach and apple in Delaware [*cf. R.A.E.*, A **21** 227] : When thorough coverage is obtained in the laboratory, summer oil at any concentration above ½ per cent. kills at least 70 per cent. of the eggs. In combination with other materials, including lime (with or without lead arsenate), nicotine tannate or nicotine sulphate, it kills practically all the eggs. On peach, 2 per cent. summer oil combined with 16–30 lb. hydrated lime, 3 lb. lead arsenate and 1 U.S. pint 40 per cent. nicotine sulphate to 100 U S. gals. spray

proved to be the most effective larvicide. Even when the lime was reduced to or below 16 lb. and the lead arsenate was omitted, the efficiency exceeded 80 per cent. On apple, 1 per cent. summer oil combined with 25–30 lb. lime, 3 lb. lead arsenate and 1 U.S. pint nicotine sulphate to 100 U.S. gals. spray, or with the arsenical omitted, proved most effective as a larvicide. High concentrations of oil with a small amount of lime cause less lime to be deposited on sprayed fruit than do low concentrations. Lime at the rate of 12 lb. or less per 100 U.S. gals. combined with 2 per cent. oil appears visibly on the fruit as a finely dispersed residue. The use of more than this amount of lime with 2 per cent. oil produces a characteristic flaky deposit. It would therefore appear that lime may lose some of its mechanical value as an ovicide and larvicide when used in amounts smaller than 12 lb. to 100 U.S. gals. spray with a high concentration of oil.

In orchard spraying experiments, no fungicides were incorporated with the oils, which are incompatible with sulphur and cannot be applied immediately before or after it. An interval of 2–3 weeks was generally found sufficient to avoid injury. In all cases where summer oil was used on peach, a considerable reduction in twig injury by *C. molesta* was effected. A corresponding decrease in fruit injury did not follow, owing to migration of moths from adjacent orchards, and to insufficient protection immediately preceding harvest. A combination of 2 per cent. summer oil, lime (decreasing from 32 to 4 lb. in successive applications) and 1 U.S. pint nicotine sulphate to 100 U.S. gals. is apparently the most effective spray for reducing infestation of peach by *C. molesta*. The results as a whole indicate that major emphasis should be directed toward the control of the twig-inhabiting first and second brood larvae by heavy applications of lime and toward that of the fruit-infesting third and fourth brood larvae by mid- and late summer oil sprays with reduced lime. A combination of 1 per cent. summer oil, 30 lb. lime and 3 lb. lead arsenate to 100 U.S. gals. spray is apparently more effective than lead arsenate alone in reducing late summer infestation of apple.

Arsenical analyses of fruit at harvest indicate that late summer applications of oil on apple tend to " fix " the previous arsenical residue and that the presence of hydrated lime in such sprays facilitates removal of this residue. Although no tests were conducted to determine the oil tolerance limit for peach and apple foliage, observations showed no injury either to foliage or fruit from the application of 2 per cent. oil on peach and 1 per cent. on apple in combination with hydrated lime.

CHAPIN (E. A.). **A new *Listrochelus* injuring *Pinus ponderosa* Lawson in the Rocky Mountain Region (Coleoptera : Scarabaeidae).**—*Proc. biol. Soc. Wash.* **47** no. 16 pp. 93–94. Washington, D.C., 13th June 1934.

The Melolonthid, *Listrochelus langeri*, sp. n., the adults of which are recorded as damaging the foliage of *Pinus ponderosa*, is described from New Mexico, Utah and Colorado.

CLAUSEN (C. P.). **The Natural Enemies of Aleyrodidae in Tropical Asia.**—*Philipp. J. Sci.* **53** no. 3 pp. 253–265, 6 refs. Manila, March 1934.

A list is given of the natural enemies attacking Aleurodids in tropical Asia, based on the literature, particularly a paper by Silvestri [*R.A.E.*,

A **16** 127], and on investigations carried out by the author during 1929–31. The abundance of the host species and of their parasites, hyperparasites and predators is discussed. In addition to the natural enemies of *Aleurocanthus woglumi*, Ashby [**21** 188], which are also recorded as attacking other Aleurodids, the species found by the author included : *Prospaltella clypealis*, Silv., obtained from *A. spinosus*, Kuw., on *Hibiscus* and *Anona* in the Philippine Islands and *Aleurocanthus* sp. on *Anona* at Singapore ; *P. strenua*, Silv., from *Aleuroplatus* sp. on *Ficus religiosa* in Malaya, *Dialeurodes eugeniae*, Mask., on *Eugenia* in the Netherlands Indies and *Asterochiton* sp. and *Bemisia giffardi*, Kotinsky, on *Citrus* in both areas ; the Scelionid, *Amitus hesperidum*, Silv., from about 50 per cent. of *Aleurocanthus citriperdus*, Quaint. & Baker, on *Citrus* in eastern Java ; and *A. hesperidum* var. *variipes*, Silv., from *Aleurocanthus spiniferus*, Quaint., on *Citrus* in Sumatra. The last-named parasite was abundant at an altitude of 4,500 ft., but was not present near sea level. At the time of the first examination, the adults were numerous on the foliage and the females were ovipositing in the newly hatched larvae and also in those that had begun feeding. The trees were heavily infested by the Aleurodid, but were practically free from it 6 months later.

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Jancke (O.). **Ueber die Giftigkeit einiger im Pflanzenschutz gebräuchlicher Fluorverbindungen.** [A Review of the Literature on the Toxicity to Man and Animals of some Fluorine Compounds used in Plant Protection Work.]—*Anz. Schädlingsk.* **10** nos. 5–6 pp. 55–58, 68–71, 21 refs. Berlin, May–June 1934.

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Webster (R. L.) & Marshall (J.). **Arsenic Deposit and Codling Moth Control** [*Cydia pomonella*, L., in Washington].—*Bull. Wash. St. agric. Exp. Sta.* no. 293, 31 pp., 16 diagr., 14 refs. Pullman, Wash., April 1934. [*Cf. R.A.E.*, A **22** 217, 424.]

Newman (L. J.). **The Bdellid Mite** [*Biscirus lapidarius*, Kramer, predacious on *Smynthurus viridis*, L., in W. Australia].—*J. Dep. Agric. W. Aust.* (2) **11** no. 1 pp. 100–101, 1 fig. Perth, W. A., March 1934. [*Cf. R.A.E.*, A **22** 313, etc.]

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Saito (S.). **A Study on the Development of the Tusser Worm,** *Antheraea pernyi* **Guér.**—*J. Fac. Agric. Hokkaido Univ.* **33** pt. 4 pp. 249–266, 5 pls., 33 refs. Sapporo, June 1934.

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